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THE MEDICAL STAFF AND ITS FUNCTIONS: A STUDY IN HOSPITAL ORGANIZATION.

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Introduction.—The problem of medical organization is one of adjustment of means to ends. In order to deal intelligently with the subject of medical organization we must begin with a clear understanding of the purposes of the hospital which the medical staff serves. A preliminary consideration of hospital function will point the way to the proper form of medical organization, and will save us from the pessimistic bias of Dr. Worcester, who regards the "medical question" as the "bugbear of hospital management."[1] What, then, are the functions of the hospital?

First, we have to regard the hospital as the servant of its patients—as an institution which exists primarily for the cure of disease, for the relief of suffering, and for the promotion of the physical welfare of its patients. The medical organization of the hospital must, therefore, be based mainly upon a consideration of the needs of its patients, whether as applicants for admission, as inmates of the wards, or as convalescents.

Second, it is apparent that each hospital, by its methods and practice, is able either to further or to retard medical education and the march of the medical sciences; and since the comfort and prospects of hospital patients depend upon the development and dissemination of medical knowledge, we cannot dismiss the subject of the

[1] A. Worcester, A.M., M.D., Small Hospitals, p. 29.

medical organization of hospitals without endeavoring to ascertain its proper relation to progressive medical education.

Third, it is apparent that the work of the hospital is limited by its resources; and we are thus led to weigh carefully the economic bearings of our subject. Having in mind the primary purpose of the hospital, we shall be prepared to sanction all those expenditures connected with or influenced by medical organization, which yield a return of human life and comfort. We wish, however, to know what these expenditures are, and how they affect the results aimed at; and we desire so to regulate them as to avoid all unnecessary waste.

Fourth, we must deal justly with the men who give to the hospital the thought and effort of their best years: this for the sake of the hospital, as well as in obedience to the moral law; for if the avenues of professional growth are cut off from the medical staff, if their lives are shortened or their success hampered by worry or overstrain, the cause of the hospital will suffer.

We have, then, four general subjects for consideration: (1) The medical staff in relation to the needs of the patient; (2) the medical staff in relation to medical education; (3) the medical staff in relation to hospital economy; and (4) the medical staff in relation to the rights of its members.

I. THE MEDICAL STAFF IN RELATION TO THE NEEDS OF THE PATIENT.

THE CONSIDERATION OF APPLICATIONS FOR ADMISSION. One of the first necessities in medical organization is a system of examining candidates for admission to the wards of the hospital which will guarantee the fair and intelligent treatment of all who apply, and which will provide for the immediate and effective handling of all emergencies which require attention on the spot. The demands of patients who seek admission to the hospital are many and varied. The admitting officer will find himself called upon to decide upon the relative claims of a large number of candidates competing for admission to a limited number of beds; to exclude contagious cases in which the condition of the patient justifies transfer; to give sound advice to rejected applicants; to maintain, in the interest of rejected applicants, amicable relations with various relief agencies; and to develop a habit of reciprocity with the officers of neighboring hospitals, homes, and asylums.

The admitting officer must be guided in his work by the accepted policy of the hospital. But while he is compelled to recognize that in the admission of patients the hospital is subject to certain restrictions of space and of classification, he will nevertheless remember that illness is often so sudden and uncompromising in its attacks, and that the machinery of relief at the disposal of the hospital is so

elastic, that blind or rigid adherence to any set rule governing the admission of patients may work needless hardship and may even result in avoidable loss of life.

It is a function of the medical organization of the hospital to provide an admitting officer whose discretion and capacity will give effect to the spirit and purpose of the law, rather than to its naked letter; only through a physician of first-rate ability and character can the complex and often vital interests of applicants for admission be safeguarded. If the duty of admitting patients to the hospital is assigned to relatively inexperienced internes, who at the same time are burdened with heavy responsibilities in the wards, the wise selection of cases for admission cannot be ensured and the problems arising out of the rejection of applicants cannot be satisfactorily solved. Here, if anywhere, rapid changes in office, especially such changes as imply the frequent introduction into the admitting department of youthful men of immature judgment, are to be shunned. In the case of a large hospital the admitting physician must be ready to put aside the claims of private practice and to devote a large part, if not all, of his time and energy to the hospital; and the trustees should not hesitate to pay him a salary commensurate with the services demanded.

To state the matter briefly, we may say that, as a rule, the office of admitting physician should be filled by a salaried man, professionally mature; in the case of a large institution a resident admitting physician is desirable; internes holding office for a short time only are not equal to the delicate tasks which the admitting physician is called upon to perform, and are best excluded from the admitting department altogether, unless the hospital is provided with a medical superintendent competent to supervise closely the work of the house staff.[2]

The Grouping of Patients and the Dangers of Specialism. While the classification of patients and their assignment to the various departments of the hospital is the duty of the admitting physician, he must take the wards and departments of the hospital as he finds them. Now, in many instances, the treatment of a hospital patient is governed, perhaps more than is wholly desirable, by the special aims and practice of the department in which he happens to be placed. In the official grouping of patients and the corresponding assignment of attending physicians and surgeons, therefore, the

[2] In view of the fact that many hospitals today are content with the examination of applicants for admission by the younger members of the house staff, it is interesting to read, in Dr. Morton's History of the Pennsylvania Hospital, that when in 1802 the physicians of that institution pleaded to be allowed to transfer to their pupils the duty of examining applicants for admission, on the ground that numerous engagements frequently made it impracticable for the physicians to do the work themselves, their petition was promptly and firmly denied. The reply of the Board was as follows: "The Managers are all of the opinion that they cannot dispense with any part of the present form of admission. The Board regret that the physicians have made a request which the Managers cannot grant without infringing on the duties they owe the institution."

hospital should seek to avoid any undue exaltation of specialism; and yet there must be at least so much emphasis put upon the exploitation of special fields of medical and surgical endeavor as will encourage the development of the finest skill in diagnosis and ensure the employment of such particularized methods of treatment as have been shown to yield the best results.

A hospital the clinical departments of which are too minutely subdivided and classified, and of which each subdivision is a segregated and self-governing unit, ceases to be a satisfactory or even a safe instrument for the relief of its patients. For example, to assign a woman to a gynecological ward, where in the hurry of specialized routine she will either be made the subject of an immediate operation, or without further consideration will be dismissed from the hospital as an unsuitable case, is not the best treatment for all patients who at first glance appear to be proper subjects for operative gynecological treatment. In many such cases, further study would reveal a complex of pathological conditions, some of them susceptible to and clearly indicating medical treatment of a kind which the average busy and successful regional surgeon, whose horizon has inevitably contracted in consequence of years of concentrated devotion to a restricted field, does not habitually practise. The psychological tendencies of specialism, therefore, furnish one reason for establishing such sweeping oversight of the various clinical departments as will promote their active, liberal, and persistent coöperation. If possible, we must find the means by which such general control can be provided.

THE FUNCTION OF THE CHIEF PHYSICIAN AND CHIEF SURGEON. A single chief in command of the medical division, and an officer of similar rank in command of the surgical division, each exercising general supervision over all the wards of his department (however these wards may be subdivided or specialized), can do much to enhance the efficiency of the visiting staff and its subordinates. Under such control the patient is regarded as a ward of the hospital, having a broader claim than the patient whose professional guardian is an individual attending physician or surgeon. The grouping of many wards under one recognized head produces a community of clinical interest which is far better for many patients than the rigid maintenance of finely drawn department lines. Free trade within the surgical or the medical division, and the liveliest reciprocity between the medical and the surgical departments, are essential to the welfare of the patient. By the very character of the medical organization, patients should be guaranteed thorough treatment as human beings, and not left to the restricted interests of individual practitioners.

TREATMENT OF PATIENTS IN THE WARDS: NUMBER AND DUTIES OF VISITING PHYSICIANS. Assuming that the patient has passed the admitting office, and has become a member of a divisional or

ward group, let us inquire into his further needs, and the means furnished by the medical organization for meeting them. On his admission to the ward, the patient's first claim is for prompt attention from the physician who is to be mainly responsible for his care. The preliminary inspection of the patient should be made at once by the senior house officer; and as soon as the history of the case has been recorded and the physical examination and routine scientific investigations made (or even before these if the case is urgent), the attending physician or surgeon should promptly appear on the scene.

A proper organization will provide a sufficient number of competent attending practitioners to ensure prompt and efficient attention to every patient. Let the chief of division control as many wards as you please—the more the better; for the attending physician or surgeon, however, there should be only as many beds as he is able to keep under his eye during every day of his official duty. Once in every twenty-four hours at least the visiting officer should see every patient, and as much oftener as the circumstances of the case demand. It is dangerous to trifle with this daily rule, especially in hospitals which deal largely with acute cases. To leave the matter entirely to the judgment of the physician, or to require him to see acute cases no oftener than two or three times a week, is to sanction the negligence of the physician whose conscience gives way when the claims of private practice press hard.

Compulsory daily visits, then, should be the rule; and if this seems to bear too heavily upon men who give their services to the hospital gratis, and who are obliged to earn their bread outside of the institution, let us lighten their burden not by the omission of the attention to which the patient is entitled, but by appointing an adjunct or associate to take the place of each regular member of the visiting staff when necessity arises. The daily attendance book, in which is recorded the day and hour of each visit of every member of the visiting staff, is a true index of the hospital's vitality, and of the devotion to duty of its physicians and surgeons.[3]

Composition, Duties, and Training of the House Staff. While a daily visit on the part of the attending physician or surgeon suffices in ordinary cases, two visits daily to the bedside of every patient constitute an irreducible minimum for the senior interne of the division. This need must be kept in mind in deciding upon the number of patients to be included in one department; and the requisite number of visits should be guaranteed by a rigid regulation, to which no exception should be tolerated.

If in addition to the senior resident officer of the division and his first assistant or prospective successor, the house staff includes at

[3] The Committee on Reorganization of the Medical Staff of the Toronto General Hospital reports Dr. Osler as recommending that "the physicians should not only make their visits at stated hours but should *stay* stated hours."—National Hospital Record, June, 1906, p. 21.

least one physician, interne or externe, for every ward unit of from twenty to thirty beds, the patient will be in a fair way to receive proper routine medical attention.

In many representative hospitals, the duration of service of internes has been fixed at two years. It is a wise rule which divides equally between the medical and surgical wards the work of all new men during their first year in the institution, whether they are destined for ultimate promotion in the surgical or the medical service. Breadth of clinical experience is a desideratum of the house officer, as well as of the visiting physician and surgeon. The house physician who has served in the operating room knows the surgical point of view, which is different from his own; and he not only appreciates the utility of prompt surgical treatment in suitable cases, but estimates sanely the limits of surgical aid. Lacking actual experience in the operating room, his understanding would never be equally enlightened.[4]

The presence of the entire staff of the division should be exacted at general rounds each day. This will tend to lessen the number of examinations to which the patient is subjected, while giving each member of the staff opportunity to follow every phase of each case in his division. At the same time it will encourage an interchange of ideas which may result in benefit to the patient.

Responsibility of the Senior House Officers Not to be Shifted. The necessity for strict control of the work of the house staff will appeal to every experienced hospital manager. No physician should be made responsible for a patient, whether in the wards or on the ambulance, during the first year of his hospital service; and the absence of senior residents, even for a short period, should not be tolerated if it necessitates a transfer of responsibility to the shoulders of inexperienced men.

No Promotion without Proved Fitness. As the house officer advances, step by step, from the lowest to the highest position on the temporary resident staff, it may reasonably be demanded of him that he prove his fitness for promotion. However honestly, faithfully, and intelligently the examination may be conducted which gives the house officer his first foothold in the hospital, unfit or undesirable men from time to time will secure places on the staff. If it is understood at the time of appointment that each sub-period of service will be regarded as a period of probation, and that there will be no promotion without previous proof of fitness, better discipline and more sustained effort will result. Time and again the life of a patient rests in the hollow of the hand of the house physician or house surgeon. The hospital should see to it, therefore, that its

[4] The following rule prevails in Mt. Sinai Hospital: "Appointments to the house staff are made for a total period of two and one-half years. Appointees are assigned for service to either a medical or a surgical division; but surgical internes are required to spend six months in the medical wards, while medical internes are assigned for six months to surgical wards."

responsible house officers are fitted by character and training to act in all emergencies.[5]

THE NEED AND EFFECT OF DISCIPLINE. In the assignment of duties, the exact responsibility of each member of the staff should be so defined that blame for neglect or inefficiency will automatically be put where it belongs and credit given where credit is due. It is, of course, conceded that in an organization where the results achieved are often due to concerted group action rather than to the efforts of an individual, exact justice cannot always be done in the allotment of credit to each member of the group; and yet it is of the utmost importance to lay bare, as far as possible, the weakness of those who contribute little or nothing, and to reward, at least with moral support, the conscientious and useful worker. By following this course the hospital aids in the intellectual and moral growth of its house staff.

FACILITIES FOR SCIENTIFIC INVESTIGATION. In an organization as highly differentiated as that of the modern general hospital, there is necessarily much interdependence among the groups of workers. The efficiency of house staff and visiting staff alike is largely dependent upon the facilities afforded for scientific investigation. In the patient's interest, therefore, there must be provided a competent pathologist, exercising supervision over the pathological and bacteriological laboratories, and having some measure of control over all the laboratory work of the house staff.

Without considering, in detail, the organization of the pathological department, let me say that the usefulness of the department can be enhanced by throwing open its doors under suitable conditions to volunteer workers. In the larger cities volunteers are always available; their labor can be utilized at small cost to increase the scientific output of the hospital and to contribute to the thoroughness of the work done for its patients. The most desirable recruits for this work are men who have served on the house staff of the institution and who desire to supplement their clinical training by a period of concentrated laboratory work.

The visiting staff should have the privilege of assigning to the pathologist or his assistants all important laboratory work required in the interest of hospital patients; but in some instances visiting physicians will prefer to undertake laboratory investigations themselves, and the director of laboratories should be required in such cases to offer every possible opportunity for the proposed work.

SPECIALISTS AS CONSULTANTS. Reference has already been made to the position which should be occupied in a general hospital by the so-called medical and surgical specialties. While there is

[5] From the rules of the Boston City Hospital I quote the following: "It is, however, in all cases provided that after one term of service the promotion of a House Officer for the succeeding term of service shall be dependent upon the satisfactory performance of his duties in the department to which he has been previously assigned, and failure to satisfactorily perform his duties shall subject such House Officer to removal from his position."

danger in the multiplication of independent departments for such work, those branches which have been highly elaborated by the endeavors of special workers and the recognition of which is approved by current practice, should have due consideration. If distinct clinical departments are organized for the practice of these branches, they should be co-ordinated with the medical and surgical services, by placing them under the direct control of divisional chiefs. If specialists are not included in the regular visiting staff, the way should be made easy for the utilization of their talent and skill by naming them as a consulting or advisory staff. When engaged in the work of the hospital, consulting specialists should rank with the regular visiting physicians, and should be subject to similar control by a divisional chief.

Recognition of the Family Physician. There is another form of consultation of which it is pertinent to speak here—a form which is not generally favored by hospital men, but which from the standpoint of the patient is often desirable. I refer to consultation with the patient's own physician, who has previously studied the case outside of the hospital. The family physicians of hospital patients should be more frequently seen in the wards, not for the purpose of enlightening the hospital staff, but for the satisfaction of the patient himself.

The family physician who is not officially attached to the hospital should be given free access to the institution whenever his professional zeal or his sympathy for his patient prompts him to come; and he should be not only tolerated, but warmly welcomed when the patient expresses a desire to see him. It is impossible to insist too strongly upon the duty of the hospital to recognize, at least in this unofficial way, the right of the patient to the counsel and cheer of his familiar adviser, and also the right of the family physician to follow his patient after the latter has been admitted to the hospital.

The Period of Convalescence. We have thus far traced in outline the needs of applicants for admission to the hospital and those of inmates of the wards, and have considered briefly the kind of medical organization which these needs indicate. We arrive now at the stage of the patient's discharge.

It is the duty of the attending physician to see every acutely sick patient in his wards during each day of his service. This duty, however, does not cease when the patient enters upon the stage of convalescence, but continues to apply up to the very moment of his discharge. Indeed, the attending physician who does his full duty will acquaint himself with the plans for the immediate future of the patient who is about to be dismissed, and will endeavor by timely advice to prevent avoidable errors in conduct. Ignorance of their bodily needs is no less characteristic of hospital convalescents than of the poorer classes generally, and to prevent disease is no less the function of the hospital physician than to cure it.

CARE AFTER DISCHARGE: UNITY OF HOSPITAL AND DISPENSARY. The day of the patient's discharge from the hospital is a critical one. If continued treatment is necessary, it is the duty of the attending physician to see that the patient, if able to pay, is safely guided from the hospital into the care of his family physician, or, if a suitable subject for dispensary treatment, is directed to the proper division of the outdoor department. By a proper subordination of the physicians of the dispensary either to the attending staff or to the divisional chiefs of the hospital, the interchange of clinical records will be facilitated, thus enabling the patient to have the benefit of continued treatment under a single medical authority. The slipshod character of the work done in dispensaries attached to hospitals famous for thorough indoor work is often due to the separate medical organization of the dispensary, and to the fact that the service in the latter receives no suitable recognition at the hands of the hospital authorities. Shorn of hospital privileges, the dispensary staff is prone to lose professional caste; the best men do not continue in its service, and the quality of its work deteriorates.

I repeat, therefore, that unity of control of indoor and outdoor services is essential to good hospital government. The method of binding the two departments may vary in its details, but a form worthy of special consideration is that adopted by hospitals whose surgeons to out-patients serve alternately as assistants to the visiting surgeons of the hospital. Under this system the visiting surgeons have a double staff of assistants, one staff being occupied in the wards while the other is on duty at the dispensary.[6]

EXECUTIVE CONTROL OF THE DISCHARGE OF PATIENTS. If the interests of the patient require to be safeguarded in the admitting-room and in the wards, it is no less necessary to impose a reasonable check upon the discharge of patients from the hospital. Neglect of the rights of patients awaiting discharge is not creditable to any hospital, for mistakes made at the last moment may undo the good of weeks of careful treatment. In large hospitals the supervision of recommendations for the discharge of patients may profitably be entrusted to an executive officer, preferably a medical man, whose business it should be to keep in close touch with all the patients in the hospital. He should be familiar with all the charitable relief agencies in the community which are capable of dealing with any phase of the physical or social needs of former hospital inmates, social needs being here included because of the frequent interdependence of social condition and physical ailment.

THE PATIENT'S INTEREST IN MEDICAL EDUCATION. In considering the medical organization of the hospital we have thus far kept in view the immediate needs of the patient. Before passing to the

[6] For details of a method of uniting the clinical practice of hospital and dispensary, consult the rules of the Massachusetts General Hospital.

question of the relation of the staff to medical education, we should perceive that the new point of view is not wholly dissociated from that of the patient's interest. Hospitals which are engaged in the promotion of medical education are bound to maintain high standards of professional achievement; their staffs enjoy the inspiration of teaching and are compelled to keep abreast of the times. Such hospitals are constantly in the public eye, are subject to the keenest criticism from without and within, and, owing to the rivalry among teaching institutions, are bound to favor any policy which will enhance their efficiency. So manifest are the benefits derived by the inmates of a hospital from the school atmosphere, that hospitals which endeavor to promote medical education need not justify their policy, however readily they might do so, by pointing to its good effects on later generations and in distant communities—effects which will be dwelt upon in the following section.

II. THE MEDICAL STAFF IN RELATION TO MEDICAL EDUCATION.

THE MISSON OF THE HOSPITAL. If it is true, as Dr. Withington[7] has said, that "the mission of the hospital is to the sick poor of every country and of all time," it will be well to bear in mind that sufferers outside of the hospitals are benefited by the training of physicians, by the advancement of pathological knowledge, and by the elaboration of therapeutic methods in hospital wards and laboratories. Accepting Dr. Withington's interpretation of the mission of the hospital, we are bound to recognize the training of physicians, the promotion of scientific medicine, and the dissemination of its teachings, as legitimate hospital functions.

WHAT IS A TEACHING HOSPITAL? Hospitals are frequently spoken of as "teaching hospitals" or "non-teaching hospitals." The principal teaching hospitals are those associated with medical schools; but any hospital which admits undergraduate students to its wards and laboratories, and even those which provide an instructive course of work for medical graduates, may claim to rank in the same class. In many hospitals, recent years have witnessed a striking growth in the house staff, and the number of highly trained practitioners has thus been largely increased. Only sixty years ago in the Pennsylvania Hospital there were but 2 resident physicians who served two years. Each of these took charge alternately of about 200 insane patients, male and female medical wards, obstetrical wards, and male and female surgical wards where there were frequently 80 patients to be dressed each day. Today in the Pine Street branch of the Pennsylvania Hospital alone there are 9 resident physicians, while the department for the insane numbers

[7] The Relation of Hospitals to Medical Education.

5 more. Mount Sinai Hospital, caring for about 400 patients, is provided with a house staff consisting of 32 recent graduates in medicine; furthermore its pathological, bacteriological, and chemical laboratories furnish work for 6 volunteers, in addition to 7 regular appointees of the department; its outdoor department employs 106 physicians, half of whom are in attendance each day. And these large figures do *not* include the regular attending and consulting staff.

It is not necessary to point out the many ways in which the welfare of patients has been promoted by the growth of the house staff, which has been one of the characteristic developments of the past generation.

THE PRIVILEGES OF STUDENTS IN HOSPITAL WARDS AND THE NATURE OF CLINICAL EXPERIMENTS. It is the boast of some hospitals that students are rigidly excluded from their wards; and this policy is intended to appeal to the prejudice of hospital supporters who regard the presence of students as inimical to the welfare of patients. But is not such prejudice due to mistaken ideas concerning the functions and privileges of medical students in hospital wards? Inquiry will show that a widespread belief exists that students are permitted to do very much as they please with hospital patients to whom they have access; that dangerous experiments are tolerated; and that needless suffering, if nothing worse, results.

Of course, no one in his right mind would willingly subject himself to reckless medical experiments. On the other hand, the physician who in his private or hospital practice never makes an experiment based upon reasonable deduction from known facts, or upon results empirically obtained by other competent professional observers, does not fully grasp his opportunities or responsibilities.

Rational and legitimate experiments in therapy, and constant study of the sciences underlying the treatment of disease, mark the progress of every practitioner who is successful in the better sense of the term; if the presence of students as witnesses of such experiments alters the situation at all, it does so in a manner which is beneficial and not injurious to the patient. The presence of students admonishes the physician to exercise his best care and judgment, since to fail before this critical audience is to suffer injury to his dearest possession, that is, his professional reputation.

If it is once made clear that the presence of students does not necessarily result in subjecting the patient to needless and cruel experiments, there remains only the familiar objection to overfrequent examination, a vice which is supposed to be peculiar to the college hospital. But by the very refusal of a majority of the hospitals to open their doors to students of medicine, encouragement is given to the introduction of unwieldy crowds of learners into the limited wards of the few hospitals which maintain an educational policy. Once bring all of the hospitals of the community into proper

relation with the medical schools, and the necessity for overcrowded clinics disappears.

There is, after all, no great difference between admitting advanced undergraduate students to the wards, which few hospitals are willing to do, and accepting as members of the house staff men who enter as graduates after completing four years of theoretical study, which is the common policy. In greater and greater numbers recent graduates are obtaining recognition as part of the hospital staff; this phase of hospital development will only be completed when the law requires every man who desires to enter upon the practice of medicine to show credit for at least one year of hospital work, and when hospitals so modify their organization as to provide places for a reasonable number of non-resident undergraduate pupils who will carry into private practice the results of an experience for which no substitute exists, and whose presence in the hospital will stimulate the attending staff to greater effort and will thus increase immeasurably the power of the hospital for good.

Control of House Staff by Medical Superintendent. As the house staff grows from year to year, and as undergraduate students take their place beside the members of the graduate staff, the need of strong government increases. For administrative purposes it is wise to subordinate the house staff directly to the superintendent of the hospital, if the latter is a medical man, and to emphasize his authority by the title of "Resident Physician and Superintendent" or "Medical Superintendent." The value of such control increases in proportion to the size and complexity of the hospital. Especially in hospitals where teaching is systematically done, an administrator of professional training, familiar with the aims and methods of medical education, in sympathy with its ideals, and yet cognizant of the inviolable rights of patients and awake to every avenue through which abuse may enter, will prove of inestimable value to the college faculty and a bulwark of safety for the patients.

The Training of Nurses. The admission of medical students to the wards of the hospital or, as a substitute for this, the organization of the resident staff upon a liberal and systematic scheme, does not complete the educational work of the hospital. While the training of nurses is of relatively minor importance, this training can be carried out nowhere else so effectively or economically as in a hospital. If hospitals have been readier to accept an educational function with reference to nurses than in connection with the teaching of medical men, it is because trustees early perceived the economical advantage to the hospital which lay in its association with the training school for nurses.

Lack of time forbids extended discussion of the methods of the hospital training school. In passing, I shall only express the opinion that, having undertaken this educational work, hospital managers

owe it to their pupils to provide an efficient teaching staff, whether paid or unpaid. Furthermore, the time and strength of the nurse must not be exhausted in the performance of menial or routine duties which form a proper part of her work, but which need to be supplemented by theoretical instruction, if the nurse is to enter properly equipped on the private practice of her profession.

THE PLACE OF MEDICAL RECORDS IN THE PROMOTION OF MEDICAL SCIENCE: THE REGISTRAR. We must not overlook the value to medical education and to the promotion of medical science which lies in the careful preparation of clinical records and in the intelligent compilation of statistical reports. Some attempt should be made to discover, through the study of hospital records, the causes of disease and the means of its prevention. To leave the valuable records of the hospital to the chance interest of untrained juniors of the house staff or to the leisure and whim of uncomprehending clerks is a fatal error. That hospital records and clinical statistics are used so little, and that the best of them are of so little use, is attributable to the rarity of competent hospital registrars. Widespread recognition of the office of medical registrar in the scheme of hospital organization would produce an improvement in the treatment of hospital statistics from which contributions to preventive medicine and to the knowledge of disease in its social aspects would inevitably be derived.

THE GROUPING OF PATIENTS AND ITS INFLUENCE UPON SYSTEMATIC STUDY. Touching the relation of the visiting staff and its organization to medical education, let me say, at the risk of seeming repetition, that if the fragmentation of the hospital service is avoided and the medical and surgical divisions respectively are grouped under single heads, the systematic study of cases and rational experimentation will be facilitated. The number of patients to be assigned to each attending officer should be so limited that a thorough study of every case may be reasonably assured.

RELATIONS BETWEEN VISITING STAFF AND PATHOLOGIST. In order to guarantee proper coöperation between the visiting and the pathological staff, the pathological department should be under the control of the divisional chiefs. The chief pathologist, whether resident or visiting, should receive a fair salary, because he cannot derive from his work in the hospital the pecuniary advantages which accrue from their hospital connection to attending physicians and surgeons. In return for his salary, the pathologist should be required to give to the work of the hospital as much time and personal effort as may be required to work up properly the material assigned to his department. In the performance of this duty, he is entitled to the aid of a reasonable number of assistants.

CONNECTION OF STAFF WITH OTHER HOSPITALS. I believe that, contrary to the rule of some hospitals, the association of attending physicians and surgeons with medical schools and with other

hospitals should be encouraged for the purpose of multiplying the sources from which knowledge applicable to the work of the hospital may be derived; but no such association with its consequent demand of time and service should be accepted as an excuse for the neglect of hospital duty.

OBJECTION TO ROTATION IN WARD SERVICE. In order to extend the privileges of the hospital to a wide circle of the medical profession, it is advisable to limit the number of beds assigned to individual attending physician and surgeon and provide a substitute or adjunct for each. The superiority of this plan over one which includes larger individual services with frequent rotation of duty is due to the fact that frequent changes interfere with that continuity of study and observation which best promotes discovery.[8]

If the foregoing recommendations are adopted, the hospital will be in a fair way to enlist in its work the students, the thinkers, the leaders of the medical profession. Having secured the co-operation of these powerful factors in its work, it should treat them in no niggardly manner, but with a cheerful spirit should place in their hands the means to carry forward their life work.

III. THE MEDICAL STAFF IN RELATION TO HOSPITAL ECONOMY.

From the standpoint of hospital economy the organization of the medical staff may be studied with regard to its effects upon hospital income and upon hospital expenditure. The most casual observation reveals the many ways in which the daily labors of the medical staff are bound up with hospital expenditure. The connection between medical organization and hospital income is less intimate and less apparent, and yet it is by no means negligible; for example, hospital appointments and privileges constitute not only a possible, but in some instances an actual, source of income. Further sources of income which require regulation and development are the collection of fees from medical students and medical colleges, and charges made to private patients.

THE SALE OF STAFF APPOINTMENTS AS A SOURCE OF INCOME. Unfortunately, the sale of hospital appointments is not unknown. It is more especially the expedient of small institutions, whose ambitions soar above their means and who have yet to learn the superiority of patient and painstaking clinical achievement over momentary spectacular financial success. The practice of selecting candidates for hospital appointment chiefly with a view to increasing the income of the hospital by levying upon the fortunes or the influence of appointees is fraught with danger, because it opens the

[8] Dr. A. G. Gerster, The System of American Hospital Economy, Medical Record, December 2, 1905, advocates continuous service as against rotation in service, on the score of *economy* as well as of efficiency.

door to wealth while it bars out worth and talent. The true success of a hospital is measured by the good accomplished and not by the assets accumulated, and the only admissible test of fitness for appointment is ability to do the work and to promote the interests of the institution. Even if commercial standards were admissible, I believe it could be shown that in the long run the services of a visiting physician of marked ability will do more to enhance the popularity and increase the wealth of an institution than any contribution of ready money linked to the work of an unfit man.

THE PAYMENT OF FEES BY MEDICAL STUDENTS. In one form only is the acceptance of money from medical workers justifiable, and that is when fees are paid by medical students in whose interest facilities for teaching are maintained. As long as the number of hospitals to which students are admitted is limited, those which open their doors to undergraduates will find their participation in medical education costly. As an illustration of this let me call attention to the problem facing the managers of a hospital which is soon to be built. The trustees of this institution have been informed by their medical adviser that if a teaching hospital is built—that is, one having amphitheatres, demonstration-rooms, lecture-rooms, cloak-rooms, and students' laboratories—the available fund will produce a hospital of only two hundred beds; whereas the elimination of teaching facilities would enable the committee to erect a hospital of three hundred beds.[9]

The large relative cost of a teaching hospital today is due to the fact that teaching hospitals are so few, necessitating extraordinary expenditures on the part of the handful which undertake a duty that really belongs alike to all. But taking the situation as we find it, is not a hospital justified in stipulating for the replenishment of its treasury by those who, not being objects of charity, help to deplete its funds? If so, the hospital is entitled to a fee from every undergraduate student who enters its doors.

The thought suggests itself, that if the privileges afforded to the non-resident students are valuable, of how much greater value are the far-reaching privileges which are open to the resident house staff, who come to the hospital fresh from college, bursting with book knowledge, but wholly lacking in clinical experience? These men, however, give all their time to the hospital, and the service exacted of them offsets their privileges. The exaction of fees from the regular house staff would, therefore, be inequitable, though I do not doubt for a moment that in declining to enrich itself at the expense of its staff the hospital renounces a handsome income.

PRIVATE PATIENTS AS A SOURCE OF INCOME. We have next to consider the bearing of medical organization upon the admission of private patients, from whom many hospitals derive a large part

[9] The Brigham Foundation, Boston, Mass.

of their income. In hospitals which combine private and public wards, the organization and distribution of the staff, the number of appointments made, and the extent to which hospital privileges are accorded to irregular members or non-members of the staff, have an important effect on income. In the adjustment of these matters, at least in hospitals which exist primarily for charitable work, the chief consideration must be the welfare of the patients in the charity wards.

I have no doubt that any superintendent who chose to do so could largely augment the income of his institution by encouraging applications from patients able to pay and discouraging the admission of patients unable to do so. This could be accomplished with particular ease if the hospital followed the policy of one of the oldest hospitals in the East, the members of whose staff are compelled to give their services gratuitously to all the patients of the hospital, whether occupying charity beds or high-priced private rooms. The result of generally introducing this policy would be to ruin private hospitals and sanitariums; to curtail the legitimate incomes of medical men; to crowd out of mixed hospitals a large number of poor patients unable to pay either for hospital accommodations or for treatment; to give free treatment to persons who do not deserve it and in many instances do not even desire it; and, finally, we must admit, to add large sums to the incomes of semi-private hospitals. But, happily, the encouragement of the *business* of the hospital, that is to say, the careful fostering of its pay patients' account at the expense of its charity work, is not the sort of social service in which most of us are engaged. Our hospitals are primarily charitable institutions, and we must not, in their management, acknowledge subserviency to business principles which do not properly apply to the work in hand.

Appointments to the Regular Staff Not to be Governed by the Needs of Private Wards. The organization of the medical staff of the hospital proper, by which I mean the public wards, must not be sacrificed to the business needs of an overgrown department for private patients. The test of the worth of a hospital physician is his ability and faithfulness in caring for the hospital's charity patients; if in addition to this he is able to send many patients to the private wards, well and good; if not, his position on the staff must not be jeopardized. While, as a rule, private wards will not yield any considerable surplus revenue, yet they ought financially to take care of themselves; and in planning the medical organization of this department the hospital will do well to extend its privileges to a circle sufficiently wide to guarantee a self-supporting department. This can be done and should be done without prejudice to the charity service.

From time to time hospitals will find themselves in the dilemma of a hospital well known which, having erected a large building for pay patients, found that the maintenance of this building was

so costly as to constitute a drain on the treasury. Private wards half empty did not pay; and for its own protection the hospital was compelled to abandon the restrictions formerly placed upon the treatment of patients in its private wards. These privileges, originally confined to the regular attending physicians and surgeons of the charity wards, were now extended to former members of the house staff and to older members of the dispensary staff, and the financial strain was thus relieved. Observe, however, that in this instance the difficulty growing out of an overbalanced private department was overcome without in any way interfering with the medical organization of the hospital proper, the characteristics of which must be determined by the needs of the chief class of its patients, and without regard to financial considerations.

The Relation of the Visiting Staff to Hospital Expenditure. Having thus briefly alluded to the points of contact between medical organization and hospital income, we may pass on to the subject of hospital expenditure.

It is customary to assume that the attending staff is careless in regard to the use of hospital property, that its example is communicated to the house staff and nurses, and that hospital expenditure is thereby increased. While there is some truth in these suppositions, the underlying cause is disregard of the principles of economy in the medical organization of the hospital. Is it not a blunder to cut off, by an artificial gulf, the professional conduct of the hospital from its business administration? The functions of the two departments are not only complementary—they shade into one another and are not practically separable.

Much can be gained for economy in the use of supplies by providing a place in the medical hierarchy for the chief executive officer of the hospital—an arrangement which, as already pointed out, is desirable on other grounds also. But this inclusion of the chief resident administrative officer in the medical system of the hospital is only a beginning; it places him in close official contact with the medical staff, enabling him discreetly and without offence to admonish them of their oversights.

The Presentation of Economic Reports to the Medical Board. Of greater importance is a clear understanding and a systematic use of the economic facts in regard to medical administration. It is not reasonable to expect visiting physicians and surgeons to devote their time to a study of the details of hospital expenditure, a study foreign to their daily thought; but it is both reasonable and just to require them to give at least so much time to the subject as may be necessary to familiarize themselves with facts ascertained through systematic records, showing in detail, and by comparison of ward with ward and department with department, the amount expended for all supplies which are used in the discretion of the medical staff. These facts, thoroughly digested

and graphically described, should be presented at regular meetings of the medical board of the hospital, accompanied by pertinent recommendations by the lay board or superintendent. Why may not the reading of such reports constitute a routine part of the monthly business meeting of the medical board, so that there can be no shirking of the duty of preparing the reports and no chance of overlooking their significance? This is but one phase of that coöperation with the chief executive officer of the hospital which should be kept constantly in mind and which should be encouraged to the utmost in the determination of official relations.

THE ITEM OF MEDICAL SALARIES. With every medical appointment there should go a suitable reward for the service exacted. It is a mistake to lean too heavily upon the supposed altruism of the medical staff. The beginner who enters the service of the hospital fired with zeal for mankind may find his ardor cooled by the contemplation of the material needs of a growing family. While participating willingly in the work of the hospital, he cannot shirk his responsibilities as a citizen, husband, or father, nor is it right for the hospital to belittle these claims.

For the attending physician, who gives only part of his time to the work of the hospital, and who secures in return opportunities for study and teaching and prestige associated with these, there need be no question of salary; for the house staff, too, the professional rewards are surely commensurate with the sacrifices made; but medical men who devote all or a large part of their time either to executive work or to laboratory duties are entitled to be paid in money. This principle is rapidly gaining recognition; it is in accordance with it that salaries ranging from five hundred dollars to five thousand dollars per annum are now paid by the hospitals of New York to resident and non-resident pathologists and assistant pathologists. Similarly, we may note the addition of paid examining physicians to the staffs of Bellevue, St. Luke's, and other hospitals, and the payment of salaries to permanent resident physicians attached to the private wards of several hospitals in New York.

IV. THE MEDICAL STAFF IN RELATION TO THE RIGHTS OF ITS MEMBERS.

We have thus far treated the medical staff as an instrument for the accomplishment of certain ends for which the hospital chiefly exists. Before concluding it will be fair to ask, What are the rights of the men who form our medical organizations?

THE RIGHT TO REMUNERATION. The question of salaries has already been dealt with in the treatment of hospital economy. While under the prevailing form of organization salaried members of the medical staff are few, so great are the advantages associated

with hospital service that the average physician who gives only part of his time to the hospital considers himself amply repaid. The rule may be laid down that those whose opportunities for earning a livelihood outside of the hospital are directly promoted by their hospital connection may reasonably be expected to give their services to the charity patients of the hospital without money return; while those whose hospital work interferes with the acquisition of private practice are entitled to remuneration in proportion to the sacrifice made and the service rendered.

In building up a hospital organization the question of medical salaries must not be allowed to occupy too conspicuous a position. The form of organization adopted and the assignment of duties should have reference mainly to the functions of the hospital. If the proper treatment of patients requires the creation of positions which exact much and give nothing in return, salaries will find their proper place as the work of the hospital unfolds.

The Right to Collect Fees from Private Patients. Whether the attending and resident staff receive salaries or not, or whether some receive salaries while others do not, no payment of fees should be tolerated for the treatment of patients in the charity wards; but we must not permit well-to-do patients to enter the hospital for the purpose of escaping the payment of the legitimate fees of the physicians or surgeons whose services they seek.

Private wards exist for the convenience of the well-to-do classes, from whom it is right to demand suitable payment for everything furnished. The service given by the attending physician is distinct from that rendered by the hospital, and should be paid for at the rates current for such service and without deduction for the benefit of the institution. The daily or periodical charges of the hospital should fully cover its expenses, and there will then be no excuse for the exploitation of the staff by the institution.

The Right to Public Recognition. There should be due recognition, in annual reports and other official publications, of the work done by the medical staff. All the sacrifices made for the hospital and its patients are not accounted for in the subscription lists. However just we may strive to be, however sure that our scheme of organization is such that the staff is properly compensated for everything it does, many medical men, inspired by the most praiseworthy motives, will continue to contribute to the hospital far more than can ever be repaid; to these honor should be ungrudgingly given.

Permanency of Tenure and Promotion for Merit. Not by public recognition alone should the hospital reward those who give their strength unreservedly to its cause. It should guarantee permanency of tenure to those whose duties are faithfully performed, permitting them to hold office without interruption so long as they are physically and mentally capable of meeting the demands of

active service, promoting them from dispensary to hospital, from positions of small opportunity and scant emolument to places of greater responsibility and wider influence; and when their fitness for strenuous professional life is terminated by advancing infirmity, the hospital should elevate them to honorary positions which will advertise to the new generation the work that has been done and the distinction earned.

THE RIGHT TO INTELLECTUAL AND PROFESSIONAL DEVELOPMENT. Since the hospital is the scene of the chief activities of many of the best minds in the medical profession, is it not right that it should give to the intellectual powers of its staff the freest play, consistent with the good of its patients? If this is done there will be provided proper facilities for a reasonable amount of scientific research; protection from the enforced superficiality which results from the assignment of too many patients to one man; compulsory vacations to protect the self-forgetful worker from the consequences of his own zeal, and to afford opportunities for the development and training of assistants on whom larger responsibilities are ultimately to fall; permission to teach and to profit by contact with younger men, who bring with them from college new problems and the revelations of a constantly unfolding science.

PARTICIPATION IN THE COUNCILS OF THE HOSPITAL. We must not shirk the question of the right of the medical staff to participate in the hospital councils. The vital question is not whether the governing body of the hospital consists exclusively of laymen or whether it is a joint body of laymen and physicians; for in any event, from the very nature of the hospital's work, medical opinion is bound to play a large part in formulating its policies. Even when absolute power of appointment and of removal of members of the medical staff is vested in the lay board, the medical board will exercise a powerful influence if the members of the medical staff are wise, honest, well qualified for their duties, and loyal to the hospital and to one another. No body of hospital trustees can escape the influence of a medical board so constituted, and no board of trustees that is worthy of its trust wishes to do so. I believe, therefore, that the so-called "fight for medical representation in hospital management" is a needless fight.[10]

It is best to leave to the lay board without question all the power and all the responsibility of initiating hospital enterprises, of fixing the budget, of securing public or private support, of appointing executive officers, of receiving and disposing of legacies and donations. In matters that are purely medical or in which the professional qualifications of medical men are concerned, the medical staff is entitled not only to exercise its moral influence, but to have

[10] A. A. Eshner, M.D., Medical Representation in Hospital Management, Phila. Med. Jour., September 20, 1902.

representation and voice. I know of no better plan to secure this than that which has long been in operation at Mt. Sinai Hospital, where a standing committee of the board of lay directors, and a committee of like number appointed by the medical board, are united in a conference committee. This committee meets at the call either of the president of the hospital or of the president of the medical board; and all medical matters affecting the interests of the hospital are referred to it for consideration and report before final action is taken.

The rights of the medical staff are as few and as simple as their duties are many and involved. But few as they are, their proper recognition is an indispensable condition of healthy hospital organization. To uphold them there is needed not so much a militant medical board, with a conspicuous chip on its shoulder, as an honest acceptance of duty, sympathy with the aims of the institution, and a self-respect which scorns professional jealousy. In the hands of a medical board which stands ready to promote talent, to reward industry, and to labor devotedly for the welfare of the hospital, the rights of the medical staff are secure.

ABNORMAL INVOLUTION OF THE MAMMARY GLAND, WITH ITS TREATMENT BY OPERATION.

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The changes which take place in the mammary gland of the female during the declining stage of its life history are very radical, and lead eventually to an almost total disappearance of the gland tissue, including both ducts and acini. It is during the period of this profound change that we meet with the condition commonly known as "cystic disease" of the breast. Coming, as it does, at a period of life when cancer is most frequent, and presenting symptoms which it is often most difficult to distinguish from those of that much-dreaded disease, this affection assumes a clinical importance which has long been recognized by both patient and physician.

To the lay mind a tumor of the breast is so suggestive of cancer that the patient is quite ready to submit to any measure, however radical, for its relief. Uncertainty as to the true nature of cysts of the breast has given rise in the professional mind to a diversity of opinions. By one a cyst is considered a harmless lesion which may be let alone, and this advice is often given, as the physician fears to place the patient in the hands of a surgeon who is inclined to amputate, as a routine treatment, every breast, whether it be the seat of a cyst or a malignant growth.

The true position of mammary cysts in the catalogue of morbid processes becomes, therefore, one of great importance from a practical point of view. Cystic disease of the breast has long been the object of careful study both by the surgeon and the pathologist. Opinions seem to have been divided as to whether cysts are formed in the breast by obstruction solely, as was the view of the older pathologists, or whether an active new-growth of acinal epithelium was an essential factor in their development. Since Réclus, in 1887, called attention more especially to the epithelial origin of these structures, many different theories have been advanced to explain the occurrence of these multiple cysts in the involuting breast.

In a paper read before the American Medical Association,[1] I have endeavored to classify these theories into three main groups. The first of these may be described as the inflammatory theory, the second the new-growth theory, and the third the involution theory. König, in his paper on chronic cystic mastitis, is a strong advocate of the inflammatory origin of this condition, a view also held by many French and English surgeons. The chief points on which the inflammatory theory is based are the evidences of chronic inflammation in the round-cell infiltration and thickened stroma of the gland. The clinical course of the affection is also thought to point to its inflammatory origin, and stress is laid (König) on the swelling and tenderness of the breast, particularly at the catamenial period, and on the tendency to frequent exacerbations so characteristic of chronic inflammatory processes.

The new-growth theory is advanced principally by German observers, who see in the very marked changes in the epithelium lining the cysts and the neighboring acini evidence of neoplastic formation. Ordinarily these cysts are lined with a single layer of epithelium, and the thin wall is typical of a retention cyst. In other cases there is a remarkable activity in this lining membrane, so that the epithelial cells become heaped up and assume a gland-like structure. A microscopic study solely of such specimens may readily give rise to the impression that one has to do with an active neoplasm of an epithelial character. This, however, is not by any means a constant condition, and the tendency to epithelial proliferation cannot be regarded as the sole characteristic feature in the development of cysts of the breast.

A later theory still is based upon a study of the process of normal involution of the breast, and presents a more rational solution of their development. As the menopause approaches, the mammary gland enters into the declining stage of its life history. Palpation of the breast at this period (between forty and fifty years) gives a nodular or shot-like sensation to the fingers which is most characteristic. This is due to a disappearance of the acinous tissue of the

[1] Jour. Amer. Med. Assoc., July 15, 1905.

gland, and to an increase in the connective tissue. Many ducts and acini may become obstructed during this process, and a dilatation ensues which results in the formation of minute cysts. To this nodular condition of the gland I have applied the term "cobblestone"—the nodules, consisting of slightly dilated ducts or acini, surrounded with a thickened connective-tissue stroma, lying close to one another, and making up the substance of one or more segments of the gland.

Up to this point the process may be considered physiological. Any exaggeration of these processes may result in more marked cyst-formation at some one point and the production of a distinct tumor in the breast, and the condition known as "abnormal involution" exists. On laying open such a breast, usually one or two larger cysts are found, and many small cysts are seen dotted over the different segments of the gland. The process is as a rule diffuse, although one lobule is often noted as the situation in which the disease is most advanced. The cysts are filled with a dark-colored fluid, and before opening present a greenish tint in contrast with the dull-white tissue of the gland, which shows a condition of marked fibrous induration. The color of the contained fluid may vary through all shades of brown, green, and black.

The age at which these cysts are more frequently found is included, in my own experience, between the forty and forty-five year limit. On examination by palpation a tumor is felt in the upper and outer quadrant more frequently than elsewhere, although any of the quadrants may be the seat of this affection. In such case the other quadrants of the breast, and the other breast also, are found to present a cobblestone sensation to the palmar surfaces of the fingers. Pain and tenderness are present in about one-half of the cases, and these symptoms are more obvious at the catamenial period. Enlarged axillary glands are detected in only a small proportion of the cases. It has been my impression, based upon clinical experience, that inversion (not retraction) of the nipple is a frequent accompaniment of abnormal involution, and it may certainly be stated that previous diseases or abnormalities of the breast, especially those which interfere with the normal function of the gland, are predisposing factors. Single cysts of considerable size are occasionally found as the result of obstruction of one of the larger ducts, caused either by a plugging of the lumen or by the contraction of a cicatrix.

There is a marked difference in the lining membrane of these cysts and one which has a distinct pathological import. In the paper already referred to, 758 cases of tumors of the breast were analyzed. Of these 115 (15 per cent.) were cases of abnormal involution. Of the 115 cases of abnormal involution, 59 showed conditions which may be classified as cystic only; that is, there existed cysts lined with a single layer of epithelium in what may be called a quiescent state

(Fig. 1, and Fig. 5, *A*). The fibrous thickening of the stroma of the gland occurring during the involution process had, in these 59 cases, produced by obstruction a dilatation of the ducts, without obvious changes in the character of the epithelium. In the remaining 56

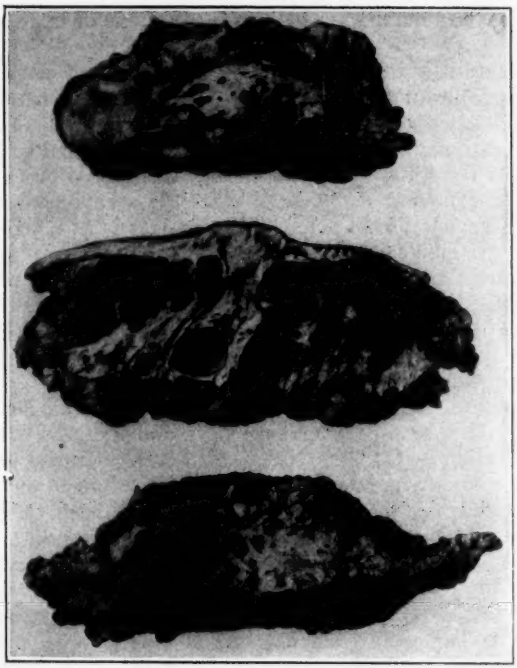

FIG. 1.—Abnormal involution, cystic type. Three parallel sections from the same breast showing the extensive involvement of the gland. The central section is made through the nipple. Under the skin is considerable subcutaneous fat, and beneath this is seen the gland tissue which reaches the surface at the nipple. The ligaments of Sir Astley Cooper connecting the breast with the skin are plainly seen. The breast is riddled with cysts varying up to 1.5 cm. in diameter, which were filled with clear straw-colored fluid. Practically no normal gland tissue is found, the breast consisting of cysts separated by a small amount of fat and considerable dense fibrous tissue infiltrated with small round cells. Microscopically, there was no epithelial proliferation, the cysts being lined by a single layer of flattened cells. The few ducts and acini found in the fibrous tissue were small and distorted.

cases the epithelial cells contained within the cysts showed evidence of a tendency to undergo proliferation. Thus, nearly half of the cases presented conditions of activity of the epithelial structures. I have, therefore, divided the cases of abnormal involution into two distinct groups—the cystic group and the proliferative group.

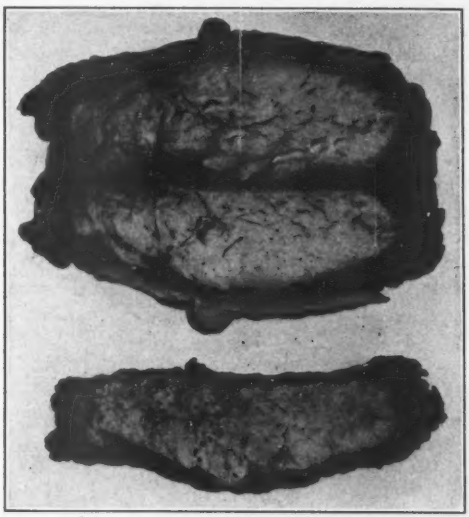

FIG. 2.—Abnormal involution with some cyst formation and epithelial hyperplasia. Two sections from the same breast showing a large amount of dense, dull, white breast tissue. The breast contained numerous cysts, most of which were small, one, however, being 3 cm. in diameter. These were filled with opaque greenish fluid. The cut surface showed many minute translucent points representing acini, and microscopically there was considerable epithelial hyperplasia. The other breast (Fig. 3) was similarly affected, but the cyst formation was not quite as marked.

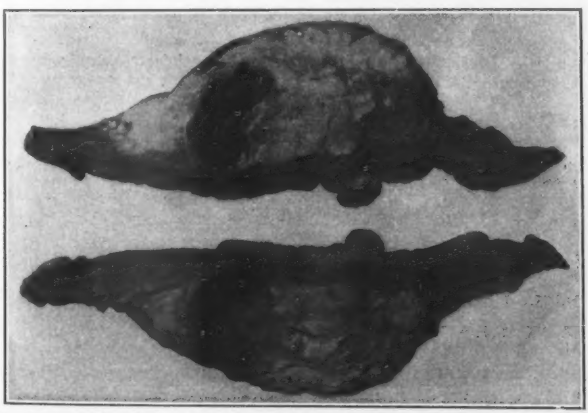

FIG. 3.—Abnormal involution with cyst formation and epithelial hyperplasia. The specimen is from the same patient as Fig. 2, and shows the condition of the other breast. Microscopic examination of the breast showed some increase in the number of acini; the ducts were somewhat dilated and the epithelium lining them was heaped up, forming in some papillary projections, and in others completely filling the lumen.

Abnormal Involution.

I. Cystic group.

II. Proliferative group.

(*a*) Acinal form.

(*b*) Papillary form.

(*c*) Adenomatous form.

Although it is possible thus to divide cases of abnormal involution into several groups according to the pathological changes present in them, it should be stated that clinically we find no characteristic which enables us to distinguish these forms from one another.

This brings me to the principal purport of this paper, which is to call attention to the more or less active epithelial processes which are going on in nearly half of the cases of abnormal involution.

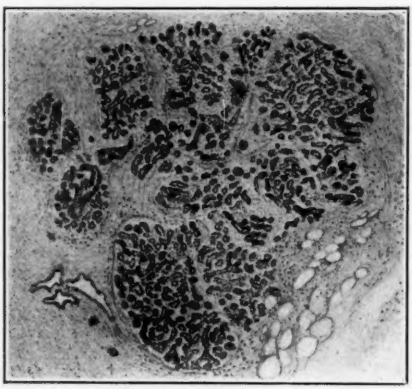

FIG. 4.—Abnormal involution, acinal hyperplasia. The acini are actually increased in number as compared to what is usually found in a quiescent breast from a woman of the same age. Other sections from the same breast showed cystic changes, but epithelial changes—other than the acinal type—were not marked.

Of the proliferative group of cysts we may distinguish three subdivisions, according to the character or degree of the epithelial growth: (1) Proliferation of the acini, (2) papillary outgrowth of the epithelium into cysts, and (3) adenomatous proliferation of the epithelium. Of this group of 56 cases, 36 were hospital cases, and the data preserved made possible a careful microscopic analysis of the varying conditions of the epithelium. Of these, 10 came under the first group (Figs. 2, 3, and 4). Here there was an apparent increase in the number of gland acini when compared with normal breasts of the same age, and conditions of marriage, childbirth, and lactation. This increase in the number of acini was accompanied in the majority of instances by a proliferation of the epithelium to such an extent that thickened or even solid columns of cells were produced, retaining, however, the characteristic formation of gland

ducts and presenting no infiltration beyond the basement membrane. Although this group gives no direct evidence bearing upon the possibility of a transition from involution to carcinoma, it should be stated here that in 3 cases of cancer of the breast occurring in the above series of 758 cases of tumors of the breast, this form of abnormal involution was also observed.

The second class of epithelial proliferation observed was one which may be described as papillary proliferation (Figs. 2 and 5). By this term is meant a growth of epithelium in the cyst cavities of such a nature that the epithelial cells become heaped up and pro-

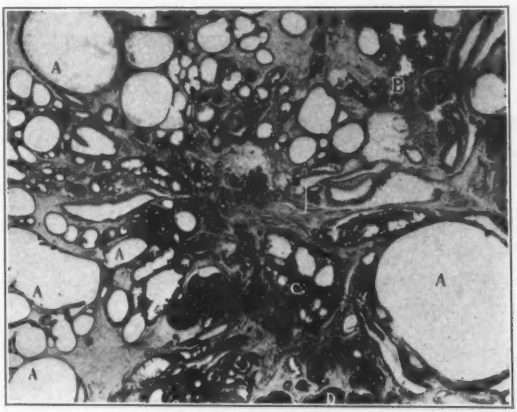

FIG. 5.—Abnormal involution with marked epithelial hyperplasia and adenocarcinoma. (Low power photomicrograph.) The section shows very extensive cyst formation and the papillary and adenomatous types of epithelial change. Most of the cysts, particularly the larger ones, are lined with a single layer of epithelium. Many of the small cysts are filled with solid masses of epithelial cells, which in places have a tendency to form atypical glands. Where the proliferation is not as marked the cells are heaped one upon another, forming papillary ingrowths. In places the epithelium has broken through the basement membrane and is infiltrating the surrounding tissue. This infiltration is not well seen on account of the low magnification. *A*, simple cysts; *B*, papillary epithelial projection; *C*, adenomatous arrangement of proliferated epithelium; *D*, adenocarcinoma.

ject into the cavity without a connective-tissue pedicle or support. The microscopic picture of this condition suggests that more epithelium is produced on the cyst wall than can be accommodated on the basement membrane, with the result that certain portions are forced out toward the centre of the cavity. There were 18 cases of this type of abnormal involution.

The third and last type of epithelial proliferation is that to which Tietze and Greenough and Hartwell have applied the name of "adenomatous" proliferation (Figs. 5 and 6). This condition must be regarded as a somewhat more advanced type of epithelial growth, one in which the papillary outgrowths from different portions of

the cyst wall appear to meet and fuse together. The resulting microscopic picture is that of a space filled with epithelial cells, in which here and there an open gland lumen is observed. This form of proliferation occurred in 8 of the hospital cases and in 4 of the cases from private practice. This variety has a special interest from the fact that it is precisely under these conditions that we most frequently find the combination of abnormal involution and carcinoma. The transition stage is observed when the epithelium no longer confines itself to the cyst cavity, but breaks through the limiting membrane and infiltrates the adjacent structures. In such microscopic specimens cyst formation and carcinoma may

FIG. 6.—Abnormal involution with extensive epithelial hyperplasia and adenocarcinoma. (Photomicrograph from the same section as Fig. 5, higher power.) The section shows in one portion a simple cyst lined with somewhat flattened epithelium. In the other cysts the epithelial overgrowth is more marked, and papillary projections are well shown. Near the centre of the section is an area of adenocarcinoma. *A*, simple cyst; *B*, cyst with papillary projections; *C*, adenocarcinoma.

be seen at either end of the field with the intervening transition stage (Figs. 5 and 6).

In 9 cases of cancer of the adenocarcinoma type and in 3 cases of the medullary type there were associated involution changes of a papillary and adenomatous character. We find, therefore, that in a collection of 115 cases of abnormal involution, 15 cases of this disease in combination with carcinoma were obtained, or 13 per cent. This figure closely approaches the actual condition, but is somewhat greater than the 10 per cent. found by Tietze and Greenough and Hartwell.

Thus we see that in a certain proportion of cases we have the possibility of cancer to face, although the great majority of cysts of the breast are of a benign character. Spontaneous rupture of a

large cyst is a not uncommon occurrence, the patient believing her tumor to have disappeared, and it is probable that quite a number of patients have obtained a spontaneous cure in this way, but the history of a large number of cases in my experience is that the cyst has reformed. Eventually the breast may become riddled with cysts of a large size, and the gland tissue totally disappear, both breasts often being affected. Occasionally suppuration is observed, but this is of rare occurrence. More frequently the disease becomes stationary at a certain stage of its development, but always remains as a menace and a source of anxiety to the patient.

The following cases are given as illustrating fairly well the different types of this affection. The hospital series (Cases I to IV) has been selected from the collection of cases already referred to; Cases V and VI are from private practice.

CASE I.—*Abnormal Involution with Cyst Formation and but Little Epithelial Change.* The patient, a widow, aged forty-eight years, had had no children. Ten years before presenting herself for treatment she received a blow on the left breast, and two months before, a tumor appeared at that point, and increased slowly in size, without pain. On examination, in the upper outer quadrant of the left breast was a hard, freely movable new-growth the size of an English walnut. It was not tender. The nipple was normal, and no axillary glands were noted. A quadrant of the breast was excised.

Pathological report (abstract): The specimen consisted of an irregular piece of breast tissue and fat 2 x 4 x 6 cm. in diameter. On section there was a large amount of dull-white breast tissue in which a few glistening points representing acini could be seen. In one place was an opened cyst 2 cm. in diameter. Microscopic examination showed a few acini separated by a large amount of fibrous tissue. The periductal fibrous tissue was also increased, and there was considerable small round-cell infiltration. The ducts were dilated, forming small cysts lined with a single layer of epithelium, and contained cholesterin crystals and detritus.

CASE II.—*Abnormal Involution with Acinal Hyperplasia and Some Epithelial Proliferation.* The patient, aged forty-nine years, was married, but had had no children. She had, at the time of examination, a tumor in the breast the size of a hen's egg, which she had noticed for six weeks. It was not painful or tender and was freely movable. The nipple was normal, and there were no glands in the axilla. A plastic resection was performed.

Pathological report (abstract): A piece of breast tissue was received which contained numerous cysts, varying up to 1.5 cm. in diameter, filled with thick, yellowish secretion. Microscopically there was an increase in the number of the acini, with dilatation of the ducts. The cysts thus formed were lined in general by a single layer of epithelium, while in some the epithelium was heaped up, forming cellular papillary ingrowths.

CASE III.—*Abnormal Involution with Marked Epithelial Hyperplasia.* The patient, aged thirty-eight years, was unmarried. For one year she had noticed a tumor in the left breast which increased slowly in size, and the growth was accompanied by considerable pain. Examination showed a tumor the size of an egg in the upper hemisphere of the left breast, freely movable and not tender. The nipple was normal and no axillary glands were palpable. A plastic resection was performed.

Pathological report (abstract): A mass of breast tissue and fat 4 x 6 cm. in diameter, containing a mass of cysts varying up to 3 cm. in diameter and filled with dark-colored fluid. Microscopic examination showed some increase in the number of acini. Most of the acini and ducts were dilated and lined by several layers of heaped-up epithelium, which in places had a somewhat adenomatous arrangement and completely filled the lumen.

CASE IV.—*Carcinoma Arising from Abnormal Involution of the Epithelial Type.* The patient, aged forty-eight years, was married, and had had three children. Lactation was normal. Soon after her last confinement, nineteen years ago, she received a severe blow on the breast, but noticed no tumor until two months before examination. Since then there has been considerable neuralgic pain. On examination a hard, tender tumor the size of a lemon occupied the upper hemisphere of the left breast. It was freely movable and no axillary glands could be felt. The breast was amputated.

Pathological report (abstract): The breast showed a marked increase of the interstitial tissue, and contained many cysts varying up to 2.5 cm. in diameter. In one place was a hard, gravish area. Microscopic examination showed the ducts and acini much dilated, and all filled with epithelial cells which in a few places had broken through the basement membrane and infiltrated the surrounding tissue.

CASE V.—*Carcinoma in an Abnormally Involuting Breast.* Mrs. P., aged forty-five years; family history negative; no known cause of disease; general health excellent. Noticed, five months before examination, beneath the nipple of one breast, a nodule which had increased very slightly in size. There was one enlarged gland in the axilla. The breast and pectorals were removed, and the axilla dissected.

The breast, when cut into, disclosed an irregular tumor more or less opaque, and dotted with yellow lines, situated in the midst of the mammary gland, which had undergone some fibrous thickening. The gland, was filled with numerous small cysts. Microscopic examination showed the tumor to be a carcinoma of the scirrhus type. None of the glands in the axillary fat proved to be infected. Dr. W. F. Whitney's diagnosis was "A scirrhus cancer originating in a diffuse fibroma of the breast, with retention cysts." The operation was performed in 1895; the patient has been heard from repeatedly since and no return of the disease has been reported.

CASE VI.—*Abnormal Involution Associated with Cancer.* Mrs. D., aged forty-two years, has had two children. After the birth of the second child, she had a little soreness of the left breast. First noticed a tenderness in the breast two years before her examination, but it had only been painful for a few weeks. She then, for the first time, discovered a small nodule. On examination a nodule the size of an almond was found in the periphery of the upper outer quadrant. On palpation the gland tissue of the breast was tender and appeared to be in a state of involution. The nipples were normal. There were no glands to be felt in the axilla. A diagnosis of "cysts" was made. The patient did not report again for a year, during which time she had suffered some pain. She did not think the nodule had increased in size. No glands were to be found in the axilla.

On inquiry as to the future history of the case, I learned that the tumor having increased in size an operation was performed a year later by another surgeon, and the tumor was found to be carcinomatous and of cystic origin. Two years later there had been no return of the disease.

The frequency with which both breasts are involved is fairly well shown in a group of 41 consecutive cases. Of these in 9 both breasts were involved—in 1 case it is not stated whether the other breast was affected. In 31 the involution process was confined to one breast. We have here a proportion of nearly 22 per cent. in which both breasts were involved in the process. It is, therefore, quite important that a careful examination should be made of both breasts. It may not be amiss to give here my views as to the correct method of examining the breasts for detecting the presence of a tumor.

The patient should be requested to remove the clothing down to the waist and to throw a cloak around the shoulders. Thus prepared she should be seated in a chair with her back to the surgeon, who standing behind her chair is enabled to palpate the breast with greater ease than in any other position. Palpation should be made with the extended and rigid fingers of both hands, the mammary gland being pressed against the thorax wall without being double upon itself. The normal gland tissue will then be recognized as of a soft and almost impalpable consistency, and the presence of any induration will be readily detected. If the breast is compressed between the thumb and fingers the gland will be folded upon itself, and imaginary thickenings and tumors may easily be developed in this way.

Proceeding by the method above described, the various quadrants of both breasts should be systematically explored, after which, while in the same position, the supraclavicular regions on both sides should be examined simultaneously. Finally, the axilla should be explored while the arm is held abducted and flexed by an assistant. If

cancer is suspected it is well not to forget to palpate the abdomen in the hepatic region. I take the liberty of introducing these details, as the ordinary methods of examination are of a more or less superficial character, if the statements of patients are to be relied upon.

If the breast is in the declining stage of its life history the "cobblestone feel" will be observed in one or more quadrants, more often the upper and outer quadrant, and the surgeon must expect to find this quadrant enlarged upward and outward in the direction of the axilla. The mammary gland is often described as a trefoil in shape. The projection of the margins at certain points which this shape implies is, however, most marked in the upper and outer quadrant, so that the term "pear shape" would better describe the ordinary outline of the organ. Accompanying this condition of the gland is often an increased sensitiveness, particularly in those parts where this normal involution process is most marked.

If a cyst is present it will readily be distinguished from the surrounding gland tissue, but the examiner must not expect to detect fluctuation. Such tumors are often externally hard to the touch, and this is due to the tension of the cyst walls. The outline, as a rule, is better defined than that of a cancer nodule. As both cancers and cysts are more frequently found in the upper outer quadrant, the situation of the nodules does not throw any light upon the diagnosis.

The absence of enlarged glands in the axilla is, however, a great encouragement to hope for the absence of cancer. The presence of marked signs of involution, with the absence of glands in the axilla, is a symptom group strongly suggestive of the presence of cystic changes of a benign character.

The average age of the 41 patients already referred to was forty-four years at the time of presenting themselves for treatment. It is noticeable that there was comparatively little variation in the age recorded—3 patients only being over fifty years and 4 below forty years.

TREATMENT. The question has been raised whether this affection needs any surgical treatment. The diagnosis once satisfactorily established, many physicians may argue that surgical intervention is unnecessary, that in the fulness of time the growth of the cystic tumor will cease, and may spontaneously disappear. The patient also is easily persuaded that, inasmuch as the disease is not malignant, the question of operation may be indefinitely postponed.

It is certainly true that accidental rupture of the cyst wall may not infrequently lead to an obliteration of the sac, and aspiration of the cyst has, in the hands of the surgeon, been followed by an equally favorable prognosis. Why then interfere in so simple and easily remedied a malady? It has been the object of this paper to supply an adequate answer.

Bull, Abbé, McGraw, and others formerly advocated aspiration and evacuation of the cyst, and report cures. McGraw, however,

reports 2 cases of cancer developing after this treatment. Rupture of the cyst by forcible massage has been recommended by Herbert Snow. A large thin-walled cyst might be as easily and perhaps as painlessly evacuated in this way as by puncture, but both methods are open to the objection that numerous cysts are left untouched, the prognosis of which no one can give with any certainty. A patient recently informed me that a small cyst of the breast had disappeared after massage by a nurse. Massage seems to me a most undesirable treatment for any affection of the breast. A complicated and highly sensitive glandular structure like the mammary gland, with its numerous long, slender, and branching tubes, is easily bruised and a lesion produced which may be the starting point of serious organic disease.

The objection to operative treatment has been based in the past upon the custom which has only too largely prevailed, of amputating the breast for every suspicious lump—the surgeon leaving with unconcern the final diagnosis to the pathologist. Secure in the belief that this in the long run is a safe policy, the operator is not disconcerted to find that he has removed the breast for a benign growth.

Amputation is an operation which every woman justly shrinks from, not only on account of its magnitude, but for the great disfigurement which it involves—nothing but the threat of cancer will drive her to it. Most women also object strongly to unsightly scars, the result of an exploratory incision directly over the tumor. As cysts are more frequently situated in the upper hemisphere, incisions over this region come within the area of a surface often exposed to view. It is true that puncture of the cyst does not involve any deformity, and that a single cyst may often be cured in this way. Puncture for exploratory purposes is now pretty generally considered inadvisable, owing to the danger of spreading the infection in case of cancer. It is a procedure which, formerly advocating for diagnostic purposes, I have now abandoned.

If now a patient presents herself with a tumor of her breast, what line of treatment should be proposed? It is obvious that the consultant should be able to satisfy the attending physician, as well as the patient, by an opinion which will definitely settle some future line of action. The time has now arrived when our knowledge of the diseases of the breast should enable us to say conclusively either that there is no occasion for operative interference, that there is no tumor (and it is astonishing how often the family physician, as well as the patient, is deceived), or that the indications for an operation clearly exist.

This task I find all the more easily performed since the adoption of the method of operating to which I have given the name "plastic resection of the mammary gland." This operation involves no scar visible to the patient, or other disfigurement of the breast, and

is an operation from which the patient may be convalescent in a week's time. At the same time, the question of cancer is not only definitely disposed of, but the quadrant containing the larger cysts (which represent the tangible tumor) has been removed; the other quadrants have been explored, smaller cysts laid open, and the involution process speeded on its way to resolution of the gland tissue into simple connective-tissue elements.

The operation consists in an incision differing somewhat from the so-called Thomas incision, in that it lies principally along the outer border of the breast and extends from the lower end of the outer hemisphere along the axillary border, and is of sufficient length to expose freely the upper and outer quadrant of the breast, which is so often extended outward and upward toward the axilla. The incision being carried down to the pectoral fascia is continued on in the loose tissue between that fascia and the fascia of the mammary gland, while the other hand of the surgeon everts the anterior wall of the wound thus made and exposes freely the posterior wall of the gland. It is now easy to recognize the presence of the cyst with its slightly greenish-colored contents shining through the fascia.

The segment of the gland containing the larger cysts, generally one or two in number, should be carefully excised without opening them if possible. Although ordinarily their contents are aseptic, it is better to avoid contamination of the wound, especially if the cyst is near the nipple. This is accomplished by a V-shaped incision, the apex of the V lying directly under the nipple in the central portion of the gland. The remaining segments of the gland are now incised by radiating incisions to detect the presence of any smaller cysts. The number of these incisions may vary from two or three to six or eight. Any doubtful spot can thus be readily excised and submitted to a microscopic examination, which should be made at the time, and it is my custom always to have a pathologist present at the operation for this purpose.

It may be said here that this operation is the ideal one for exploration in doubtful cases. If the nodule is cut into and found to be cancer, the preliminary incision has already separated it from the axillary glands, and any danger of mechanical transference of portions of the primary lesion to distant parts is avoided. The incision into the nodule in this case may be closed by a suture while the operation for cancer is carried out. After the gland has been thoroughly explored by radiating incisions and one segment with the larger cyst secured, the next step in the operation is the closing of the wounds in the gland itself. The V-shaped space may be closed by a double row of sutures, so that the accurate adjustment of the sides of the V may be effected. This avoids any depression externally. The radiating incisions usually close spontaneously when the gland is laid back again upon the pectoral muscle. A stitch here and there may, however, be necessary to prevent any tendency to eversion.

The outer edge of the gland is stitched to the margin of the pectoralis in order to hold it securely in its normal position. For all buried sutures and ligatures catgut is the preferable material, as it is quickly absorbed and does not leave, like silk, a remnant behind to become a source of irritation and suspicion.

The outer wound is closed by silkworm-gut sutures. The somewhat puckered or dimpled appearance of the contour of the breast, which is at first noticeable, soon disappears as the buried sutures become absorbed, and the deeper portions of the wound adjust themselves to their new relations. The stitches can be removed within a week's time, and the patient can be promised that confinement to bed is to be of a few days' duration only. No drainage is used, and in all but 3 cases the wound has healed by first intention. In these the removal of a stitch or two for drainage was all that was necessary to produce prompt healing of the wound. In case of a large cyst, or one very near the nipple, being accidentally opened, I am in the habit of sponging the wound with a weak solution of corrosive sublimate.

It is astonishing to see how little change in the appearance of the breast is produced by the operation. The skin incision is invisible to the patient herself as she stands before the glass. At the end of two or three months careful palpation fails to reveal the site of the deep incision. It is only by reference to my notes that I am able to tell which portion of the gland has been removed. I have performed this operation for cysts of the breast in all fifty times, and have never failed to be able to make a diagnosis at the time of operation, and have never had any reports of a recurrence of cystic or other disease in the patients operated upon.

Surely an operation which is comparatively a light ordeal to the patient, which removes all doubt as to the nature of the tumor, and all probability of a secondary development of cancer, is one that should commend itself above all others. A greater familiarity upon the part of practising surgeons with the classification of tumors of this organ, and with the gross pathological appearances, would doubtless save many a breast from being amputated.

THE SURGICAL ASPECTS OF GASTRIC CARCINOMA.[1]

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Cancer of the stomach is a disease of frequent occurrence. From 25 to 40 per cent. of all cancers in the body are primary in

[1] Read at the meeting of the Southern Surgical and Gynecological Association, Baltimore, December 11, 12, and 13, 1906.

the stomach. Statistics[2] show that in Baltimore there are over 200 deaths annually from cancer; in Boston there are over 300, in Philadelphia nearly 500, and in New York nearly 900 deaths every year from some form of cancer. Of these deaths more than a fourth, and perhaps almost a half, are directly due to cancer of the stomach. Dowd[3] says that the United States Census Report for 1900 recorded 9000 deaths from cancer during that year, that 31 per cent. of fatal cancers were in the stomach, that probably many cancers of the liver and the abdomen were primarily gastric, and that many cases of gastritis and allied diseases were really carcinomatous in nature.

Medical measures are powerless to cure cancer in any region of the body. Escharotic pastes, cauterizing applications, detergent washes, serums and antitoxins, and even the subtile power of the *x*-rays and the Finsen light are all of them powerless to cure external cancer. How much more improbable it is that any save surgical remedies will cure cancer of the internal organs! That, in the case of inoperable tumors, medical measures will sometimes prolong life and mitigate suffering, no one would be so foolish as to deny. The wide experience of Jacobi,[4] so cautiously and conservatively expressed, in regard to the beneficial effects of methylene blue (methylthionin hydrochloride) in such patients, is a gratifying example of what may be done by medical science even for hopeless cases. But, as Bland Sutton[5] said a number of years ago, as long as we are ignorant of the cause of cancer, so long must the only successful treatment be the extirpation of the growth; and I may add that the sooner this is done the better for the welfare of the patient and for the reputation of the family physician and the surgeon.

If it were possible to prevent cancer, what then? Before answering this question one would have to determine the cause of cancer; and of its specific cause we are absolutely ignorant. That it is caused by some form of micro-organismal life it seems safe to infer; but beyond such an inference even the most enthusiastic pathologists will not go.[6] But we do know many of the predisposing causes of cancer, and especially well recognized are the predisposing causes of gastric cancer, which is all that concerns us now.

Mumford and Stone[7] traced 60 patients who had been treated at the Massachusetts General Hospital for chronic indigestion, and who subsequently died. Of these, no less than half died of gastric carcinoma. They further made a study of 50 patients with gastric

[2] Bryant, quoted by Van Valzah and Nisbet, Diseases of the Stomach, London, 1900, 513.
[3] N. Y. Med. Record, 1906, i, 91.
[4] Jour. Amer Med. Assoc., 1906, xlvii, 1545.
[5] Tumors, London, 1901, preface.
[6] See Gaylord, American Practice of Surgery, edited by Bryant and Buck, New York, 1906, i, 403.
[7] Surgical Aspects of Digestive Disorders, New York, 1905, pp. 87 and 201.

carcinoma, and learned that in no less than 41 of the 50 patients there was "a history either of ulcer or of long-continued digestive disturbance, of which the exact nature could not be ascertained." Mayo[8] found a history of ulcer or other disease in 36 per cent. of his patients with cancer of the stomach, and clear evidence of cancer developed on ulcer in 30 per cent. of the last 40 pylorectomies and partial gastrectomies. Moynihan[9] noted a history of gastric ulcer or chronic indigestion in 27 out of 45 patients with cancer of the stomach (60 per cent.). Among 22 patients with gastric carcinoma, so far advanced as to be operable only by gastroenterostomy, no less than 16, or over 72 per cent., gave such a history. Jedlicka[10] quotes Ssapesko as stating that among 100 cases of gastric carcinoma only 10 were found in which the cancer was not engrafted on a preceding ulcer. Further statistics could no doubt be quoted; they would merely serve to emphasize the point that I am trying to make, *that chronic gastric dyspepsia is the chief predisposing cause of cancer of the stomach.*

We know that cancer of the stomach presents clinically two forms. In one, a patient past middle life, without having suffered previously from indigestion, suddenly loses appetite especially for meats, grows progressively weaker and more emaciated, develops epigastric pain and possibly a palpable mass, becomes subject to vomiting spells every few days, which bring up a mass of coffee-ground material, foul smelling and fermented, and quickly develops the cancerous cachexia. This is the classical picture of gastric carcinoma, and it is still seen; but it is of rarity when compared with that other course of development which we have only begun to appreciate in the last few years. This second and much larger course is found in patients who have been life-long sufferers from dyspepsia. Medical treatment has at times given relief, but the indigestion recurs again and again. Appetite may be preserved, but digestion is torture; so abstemiousness becomes second nature. There may or there may not have been some period when gastric ulcer was suspected or actually diagnosticated. Usually there have been no very definite symptoms, and the patient has been treated for chronic gastritis. Finally these patients die, worn out with suffering, with prolonged starvation, and wearied with ineffectual drugging. At the autopsy a wide-spreading epitheliomatous ulcer is found, distorting the stomach, stenosing the pylorus, and binding the colon, the pancreas, the stomach, and perhaps the liver and the gall-bladder together in an indistinguishable mass of adhesions. The wonder is that such patients live so long.

Experience in the surgery of the upper abdomen within the last

[8] Jour. Amer. Med. Assoc., 1905, ii, 1211.
[9] Trans. Clin. Soc. Lond., 1906, xxxix, 84.
[10] Operat. Behandl. d. Chron. Magengeschwürs, Prag., 1904, 24.

few years has taught surgeons much, but they have learned nothing of more importance than the security and certainty with which mechanical defects in the physiological action of the stomach may be remedied by mechanical means. If chronic and rebellious cases of indigestion were promptly turned over to the surgeon, and if suitable operations were done on such patients, there would be fewer cases of carcinoma of the stomach observed by physicians. Every case diagnosticated certainly as carcinoma of the stomach before operation is a disgrace to the attending physician, provided he has had the patient under treatment for more than a few weeks. Patients who present symptoms of gastric indigestion which will not yield in that time to medical treatment should be subjected to operation; and if operation is not undertaken, and the patient's disease is allowed to continue uncured until a diagnosis of cancer has been made, the disgrace and the responsibility rest on the attending physician. We know beyond peradventure that such patients as these can be cured by operation, and that the development of carcinoma may be thus prevented. For physicians not to recognize this fact and act accordingly is not only unjustifiable, it is criminal.

The point is now reached where it will, I think, prove beneficial to compare the results of operations on the stomach for benign disease with those for carcinoma of this organ. It is of interest first to know the immediate operative mortality, and then the proportion of ultimate recoveries or cures. In considering questions such as these it is injudicious to collect isolated operations reported at random by different surgeons. Statistics of abdominal operations which are so frequently done as are nowadays operations on the stomach present, when thus collected, a picture which is too likely to be distorted one way or the other: we obtain results which are neither phenomenally good nor phenomenally bad, but at any rate results which are far from the truth. In the earlier history of an operation such figures are of value, because the cases are few, and progress can only come when a sufficient number of observations has been collected for surgeons to study the principles which underlie the operation in question. Thus twenty years ago it was important to record every individual case of gastroenterostomy or pylorectomy, because no individual surgeon had at that time had the opportunity personally of observing the effects of more than one or two such operations. But now, when the experience of one surgeon may embrace a hundred or more such cases, the deductions to be drawn from such a series far outweigh in value those which were available even one decade ago from a series of similar size collected from various sources.

Let us consider, then, first the figures of gastroenterostomy for benign disease, an operation which may, I think, justly be con-

sidered as preventive of cancer. We have reports of large series of cases of this operation at the hands of various surgeons:

GASTROENTEROSTOMY FOR BENIGN DISEASE.

Operator.	Cases.	Mortality. Per cent.
Robson and Moynihan[11]	218	3.2
Mayo[12]	81	1.23
Czerny[13]	83	4.8
Mayo Robson[14]	97	1.03
Moynihan[15]	171	1.00
Deaver[16]	40	2.5
Morison[17]	27	3.7
Hartmann[18]	47	6.3

Now, it is a well-recognized fact that about 95 per cent. of patients who survive operation for benign disease remain well permanently. Consider these figures:

END RESULTS AFTER GASTROENTEROSTOMY FOR BENIGN DISEASES OF THE STOMACH.

Operator.	Cases traced.	Permanently cured.	
Barling	7	7	100.0 per cent.
Mayo	28	27	96.4 "
Moynihan	29	29	100.0 "
Czerny	53	44	83.0 "
Robson and Moynihan	20	20	100.0 "
Paterson (collective statistics)	116	109	93.9 "
Deaver	30	30	100.0 "
Robson	96	89	92.7 "

NOTE.—The latest statistics of Mayo in gastroenterostomy for benign disease give a mortality of practically 1 per cent.: actually 1.04 per cent.—2 deaths in 192 cases. My latest statistics show a mortality of less than 2 per cent.

May we not justly conclude that by timely resort to this operation many patients have been saved from the development of gastric carcinoma?

The cure of carcinoma of the stomach, when this dread disease has once developed, demands excision of the growth with the infected glands. The immediate operative mortality of partial gastrectomy is still very much higher than is that of the operation I have been considering, though the death rate has been reduced very much within the last few years.

[11] Surg. Treat. Diseases of Stomach, New York, 1904, p. 177.
[12] Jour. Amer. Med. Assoc., 1905, ii, 1211.
[13] Petersen u. Machol, Beitr. z. klin. Chir., 1902, xxxiii, 297.
[14] Brit. Med. Jour., 1905, ii, 762.
[15] Lancet, 1905, ii, 362.
[16] Therapeutic Gazette, January 15, 1906.
[17] Brit. Med. Jour., 1905, ii, 777.
[18] Ibid., 772.

PARTIAL GASTRECTOCY FOR CARCINOMA.

Operator.	Cases.	Deaths.	Mortality. Per cent.
Mayo[19]	81 (25)	12 (1)	14.15 (4)
Kocher[20]	110 (58)	27 (9)	24.5 (15)
Mikulicz[21]	100	37	37.0
Mayd[22]	25	4	16.0
Krönlein[23]	50	14	28.0
Roux[24]	39	13	33.0
Meyer[25]	5	1	20.0
Kappeler[26]	30	8	26.6
Garré[27]	26	7	26.9
Hartmann[28]	22	7	31.8
Moynihan[29]	9	2	22.2
Paterson[30]	4	1	25.0

NOTE.—Mayo's latest statistics, as given in a personal communication, show a mortality of 11.45 per cent. for partial gastrectomy; while my latest statistics show a mortality of 11.11 per cent.

Taking, then, the more favorable recent figures of Mayo (4 per cent.) and of Kocher (15 per cent.), which offset to a certain extent the rather ancient statistics of Mikulicz, Krönlein, Roux, Hartmann, and others, we have a total of 393 partial gastrectomies with 104 deaths, or a mortality of 26.5 per cent., as the immediate result of operations for the radical cure of gastric carcinoma. This, it will be remembered, is to be contrasted with an immediate mortality of about 5 per cent. after operations for the prevention of this disease.

It will next be proper to determine what proportion of the 74 per cent. of patients who survive gastrectomy may reasonably hope to be ultimately and permanently cured of their disease. Let it not be forgotten that about 95 per cent. of patients surviving the prophylactic operation have been proved to be permanently cured. This question of the ultimate results of gastrectomy has been carefully studied by Moynihan,[31] who bases his conclusions largely on the statistics of Krönlein and Mikulicz, who alone of many operators have published in detail the terminal history of those patients whom they were able to trace. It is not the place here to discuss these statistics minutely, but it may be said that they show that patients suffering with gastric carcinoma have, under medical treatment, an expectation of life of about twelve months from the beginning of the disease. Many writers put it at less. Not only is this the duration of life, but it should not be forgotten that at the end of that time the patients under medical treatment will *all be dead.*

[19] N. Y. State Jour. of Med., 1906, vi, 63.
[20] Paterson's Gastric Surgery, New York, 1906, p. 104.
[21] Paterson, loc. cit., p. 104.
[22] Paterson, loc. cit.
[23] Paterson, loc. cit.
[24] Paterson, loc. cit.
[25] N. Y. State Jour. of Med., 1906, vi, 68.
[26] Paterson, loc. cit.
[27] Paterson, loc. cit.
[28] Paterson, loc. cit.
[29] Trans. Clin. Soc. London, 1906, xxxix, 84.
[30] Gastric Surgery, New York, 1906, p. 178.
[31] Abdominal Operations, Philadelphia, 1905, p. 223.

There will not be even one who at the conclusion of that period will have had up to that time no recurrence of the growth, and who may, therefore, still be considered as curable—as potentially cured. If then surgery can show any permanent cures, and if the average duration of life under surgical treatment is longer, or at least not less than that under medical treatment, the conclusion is surely justified that surgical intervention is best for these patients.

To compare with an expectation of life of about twelve months for patients who have not been operated on, we know from Moynihan's studies that the average duration of life in patients who underwent gastrectomy in the clinics of Krönlein and Mikulicz was, from beginning to end of the disease, as much as twenty-four to twenty-six months—more than twice as long as the average duration of life without operation. Paterson's figures[32] from collective statistics give the duration of life after operation (86 operations in all) as an average of nineteen months after total gastrectomy (17 patients), of twenty-two and a half months after subtotal gastrectomy (14 patients), and of just over two years after partial gastrectomy (55 patients). It should be noted that Moynihan's figures refer to duration of life from the first symptoms of gastric cancer, while Paterson's refer only to the duration of life after operation. With this allowance, it is seen that the figures agree very closely; and as they are gathered from very different sources (Moynihan's from the German clinics and Paterson's largely from British sources), each series serves to confirm the other.

Not only, moreover, may the mere addition to the patient's life be of utmost importance from a social, commercial, or financial point of view, but death, when it does come, will attack the sufferer in a less hideous form. The patient will not die of starvation, as he would have done had no operation been performed. And although it would be heartless in the surgeon to tell his patient, when urging operation, that although the chance of permanent cure is slight, it is nevertheless altogether likely that he will die from cancer of the liver, with its attendent cachexia, and not from progressive starvation—although, I say, to draw such a picture of the future for his unfortunate patient would be diabolically cold-blooded in the surgeon, yet I doubt not that many a patient, dying of the cancerous cachexia some two years after the operation, will daily bless the art of surgery which has so prolonged his life and mitigated his suffering during the gradual approach of death.

But, though the chances of permanent cure are slight, they are not altogether imaginary. Among more than 100 cases of gastrectomy for carcinoma, Kocher[33] has had permanent cure result in 8 patients, who were reported as living and well at periods

[32] Gastric Surgery, New York, 1906, pp. 106 and 107.
[33] Revue de gyn. et de chir. abd., 1906, x, 103.

varying from three to sixteen years after the operation. Paterson[34] has collected, mainly from British sources, the end results of 79 cases of gastrectomy, 46 patients (58.4 per cent.) dying of recurrence within three years, and 33 patients (41.6 per cent.) being alive and well at the end of three years or more after the operation. No less than 12 patients (15 per cent.) were in perfect health more than five years after the operation, some being in good health at periods varying from six to fourteen years after the operation. We may expect, then, about 10 or 15 per cent. of patients treated by gastrectomy to be permanently cured without liability of recurrence.

PATERSON'S STATISTICS OF END RESULTS OF GASTRECTOMY.

	Recovered	Traced.	Died since operation.	Still living and well. Three years after operation.	Five years after operation.
Total gastrectomy	17	14	5	6	3
Subtotal gastrectomy	14	12	6	3	3
Partial gastrectomy	55	53	35	12	6
	86	79	46	21	12

There is another question of importance in regard to the surgery of gastric carcinoma which cannot be answered offhand. This is as to the advisability of excising ulcers or of doing a pylorectomy or a partial gastrectomy in the presence of benign disease as a preventive of malignant changes. I have argued in favor of gastroenterostomy as a prophylactic operation; and it may have been cause for surprise that I have not hitherto even mentioned excision of the ulcer or of the diseased gastric area. This ommission, however, has been intentional, since I desire first to contrast the immediate operative mortality of the two forms of surgical treatment. And in doing this I am, of course, not ignorant of the fact that gastrectomy in a cancerous patient is unavoidably a more fatal operation than it is in one suffering only from benign disease. But although I am quite willing to admit this fact, yet the operation of partial gastrectomy presents *per se*, and apart from the vitality of the individual patient, certain added risks, which in the present state of surgery are unavoidable, but which must, I venture to think, be obviated before the conscientious surgeon can recommend this operation in preference to gastroenterostomy in patients with benign gastric disease. The time may come, indeed I hope it is not far distant, when the operative mortality of gastrectomy will be reduced from 25 per cent., its present figure, to less than 10 per cent., but until that day has been reached I for one cannot feel justified in resorting to the more dangerous operation in cases certainly benign. I say this, too, with full knowledge and personal experience of

[34] Gastric Surgery, New York, 1906, p. 108.

patients who recover as blithely from a gastrectomy as they do from an interval operation for appendicitis. In my own experience with gastrectomy, comparatively small though it be, I have been surprised at the freedom from symptoms and the easy convalescence of some patients on whom quite extensive operations have been done; but, although increasing experience with the operation has made me regard it as neither so difficult nor so serious an undertaking as I formerly thought it, yet I have not yet reached, and I humbly trust never shall reach, that point where familiarity will breed contempt.

The arguments advanced in favor of excision of the ulcer or of the ulcer-bearing area, sound as some of them undoubtedly are, do not, in my opinion, outweigh the arguments against this treatment, which I have already stated. Though I firmly believe that the chief predisposing cause of gastric carcinoma is long continued dyspepsia due to ulcer or other form of benign gastric disease, yet I do not altogether credit the reports which would make us believe that about 1 out of every 10 ulcer cases is already cancerous.

Originally advocated by Rydgier,[35] who has recently[36] had the satisfaction of reporting his first patient as alive and well twenty-five years after the operation, pylorectomy was, nevertheless, a method which quickly fell into disrepute, owing to its enormous mortality. But in the last few years excision of the ulcer or of the pyloric region has again become popular with some surgeons (Maydl, Jedlicka, Ali, Krogius, Rodman, and others), chiefly as a prophylactic against the development of carcinoma, though there are also other reasons (absence of subsequent perforation or hemorrhage) which they urge for its more general adoption. Yet it seems to me that a diagnosis of "carcinomatous degeneration," based on microscopic findings, as to whose interpretation pathologists themselves are not unanimous, is at least as liable to be in error as is a clinical diagnosis of malignant disease based on the naked-eye appearance of a pyloric tumor found at operation; and it seems fair to conclude that patients in the former class might be as thoroughly cured by a palliative operation as have been those patients, by no means unknown to science, who presented a gastric tumor which was considered a naked-eye evidence of malignant disease too far advanced to be treated by excision.[37]

It is, therefore, with caution that I accept the conclusions of Jedlicka,[38] who argues very positively in favor of excision of benign ulcers. Following his late master, Maydl, he records, during the

[35] Berl. klin. Woch., 1882, xix, 30.

[36] Ibid., 1906, xliii, 1207.

[37] See cases reported by Bidwell, AMER. JOUR. MED. SCI., 1899, ii, 260; Demoulin et Tuffier, Bull. et mem. de la Soc. de chir. de Paris, 1899, xxv, 833; Robson and Moynihan, Diseases of the Stomach, New York, 1904, p. 386; Wallis, Brit. Med. Jour., 1906, ii, 73.

[38] Operativ. Behandl. d. Chron. Magengeschwürs, Prag., 1904.

period from 1891 to 1904, 34 gastric or pyloric resections for benign disease, with 2 deaths, a mortality of a little less than 6 per cent. It is not his operative results that I mistrust, for they are brilliant and speak for themselves; but it is the conclusions which he deduces from a study of his cases that I think should be accepted with caution. He states that his microscopic studies (confirmed in most cases by Hlava) showed that of his patients whose stomachs were resected for gastric ulcer, supposedly benign, no less than 26 per cent. had commencing malignant degeneration. He points out, moreover, that of the 41 patients whose stomachs were resected, between 1891 and 1901, for carcinoma, not one is alive now; whereas, of the 4 patients whose stomachs were resected in the same time for supposedly benign disease, which was, however, afterward found by the microscope to be malignant, but in an early stage—that of these 4 patients, the first is well eight years after the operation, the second is well four years after the operation, the third is still too recent to count, and only 1 died of recurrence, and then only after two circular resections of the stomach. In all fairness I must add that Mayo Robson[39] has recently reported, among 97 patients operated on by gastroenterostomy for benign disease, no less than 4 who developed cancer at periods of from one to three and one-half years after the palliative operation; and that Czerny's clinic[40] furnished 3 such results among 83 operations for benign disease. But then it must not be forgotten that if these patients had been treated by the more dangerous method of gastrectomy, it might have been their fate to succumb to the operation—a result immeasurably worse than the remote and improbable chance of carcinomatous change several years subsequent to operation. So that while it is right to acknowledge the force of the arguments advanced by the advocates of gastrectomy as a prophylactic measure, I think it is a saner course to limit the more dangerous operation of resection to the more serious condition of acknowledged malignancy, and when there is doubt as to the existence of malignant disease to perform the more extensive operation, not as a routine measure, but only in carefully selected cases.

There remains for discussion the choice of operation on patients who are undeniably affected with carcinoma. Until operation is more frequently undertaken in the very early stages of the malady, gastroenterostomy must still be the operation most often adopted. It has been rare in my experience, as I think also in that of other surgeons, for a patient in whom cancer has been certainly diagnosticated before operation to present conditions admitting of gastrectomy. The operations of gastrectomy that I have done myself have been on patients in whom the existence of malignant disease was merely suspected, but not certainly known, before the abdomen was opened.

[39] First Congress of Internat. Soc. of Surgery.
[40] Petersen u. Machol, Beitr. z. klin. Chir., 1902, xxxiii, 297.

A palpable tumor felt before operation will naturally suggest cancer; but the case reports already referred to, in which such masses have been known to disappear after gastroenterostomy, prove that all palpable tumors are not carcinomatous in nature. I have urged elsewhere[41] that in this class of patients exploratory laparotomy finds its most legitimate field. The statistics from the clinics of Krönlein and Mikulicz, recently compared by Moynihan, show that patients who have undergone an exploratory laparotomy in which no further operative treatment was possible actually lived longer than did those whose disease was so far advanced as to make even an exploration unjustifiable, or those who entirely refused an operation of any kind. In very many operations, moreover, which are commenced as explorations merely, it is found possible either to remove the growth or, at least, to perform a palliative operation which will materially prolong life and relieve suffering. Surgeons, I fear, sometimes lose sight of the fact that this and not the production of statistics is the end and object of surgery.

We have a choice of radical operations for cancer of the stomach, dependent upon the extent of the disease. Total gastrectomy, though it has been adopted in no less than 27 instances, must remain, I think, an operation of the utmost rarity. Personally I do not approve it. Though 17 patients survived the operation (a mortality of over 37 per cent.), I think it probable that the mortality will rather increase than decrease if the operation be indiscriminately employed. Subtotal gastrectomy, as it is called by the French, is in my opinion as extensive an operation as it is wise to adopt. I have successfully (?) removed as much as two-thirds of the stomach, always leaving the cardiac end and the "greater tuberosity" untouched. The operation of pylorectomy, or partial gastrectomy as it is now more accurately called, is that form of excision which is most generally applicable. The mortality of subtotal gastrectomy was 30 per cent. in 20 cases collected by Paterson—all he could find records of; while the average mortality of partial gastrectomy for carcinoma is, as we have already seen, from 26 to 28 per cent.

Adhesions, I think, a more formidable objection to radical removal than size of the tumor or lymphatic involvement. Especially is this true when the adhesions involve the pancreas. Enlarged glands should always be removed when possible, but as they are frequently the seat merely of inflammatory, not of malignant changes, their number need not discourage the surgeon from attempting radical cure by gastrectomy, provided the tumor is fairly movable. Thus Taylor[42] did a partial gastrectomy in a woman, aged sixty years, excising with the tumor *en masse* some of the right rectus abdominis muscle to which it was adherent, along with some enlarged

[41] N. Y. State Jour. of Med., 1906, vi, 64.
[42] Indian Lancet, 1906, i, 668.

glands in the gastrohepatic omentum. The patient recovered, and microscopic study of the tumor showed that it was of purely inflammatory character. Still more extensive operations have been performed when the growth was really carcinomatous. Moynihan[43] has twice (once with success) excised a tumor of the stomach with the corresponding portion of the transverse colon which was implicated in the malignant growth; and a similar operation has been successfully performed by Childe[44] (for unavoidable destruction of the blood supply, not for carcinomatous invasion), who also excised a layer of pancreatic tissue.

For the restoration of the gastrointestinal canal after gastrectomy I much prefer the usual posterior retrocolic gastroenterostomy to either of Billroth's methods, or to Kocher's operation of lateral implantation of the duodenum into the posterior gastric wall. In some patients, I think, it is wise to do this part of the operation first. Paterson also has recommended this course, and suggests that while the gastroenterostomy is being done, a piece of the suspected growth can be frozen and examined under the microscope. The plan suggested a decade or more ago by Tupolske, of doing a gastroenterostomy at one sitting and postponing the gastrectomy for several weeks, is open to the objection, as Mayo Robson[45] has pointed out, that the patient may be so much relieved by the palliative operation that he will decline further treatment. In one of Paterson's patients, however, treated thus by a preliminary gastroenterostomy, good health persisted after four years; so it is probable that in this individual case it was wise for the patient to decline excision of the supposedly malignant growth.

When the carcinoma has progressed very far, so that not even gastrojejunostomy can be done, the operation of jejunostomy will relieve suffering and may prolong life. I do not think the profession in this country appreciate the degree of alleviation of suffering which this procedure affords. The fistula should be established by a technique similar to that employed by Witzel in performing gastrostomy. In such patients, after opening the abdomen, no time should be lost in idly exploring the stomach and duodenum. We should know before commencing the operation what it is desired to accomplish, and the primary loop of the jejunum should be immediately sought and attached in the manner advised to the anterior abdominal wall. I prefer the incision splitting the fibers of the left rectus muscle. Feeding should be begun almost immediately, in moderate amounts, such as would be given to a starving man under other circumstances. Rectal alimentation may also be employed, but, except for the saline solution which can be thus absorbed, it is of little value.

[43] Trans. Chir. Soc. London, 1906, xxxix, 84.
[44] Brit. Med. Jour., 1906, i, 194
[45] Ibid., 1900, i, 696.

In conclusion, I may say:

1. By timely operation for the various causes of persistent indigestion, many patients will be saved from developing gastric carcinoma.

2. Early diagnosis of gastric carcinoma being so extremely difficult, and radical removal being only highly promising when an early diagnosis has been made, partial gastrectomy should be an operation limited to cases of malignant disease operated on for symptoms of pyloric obstruction or other gastric affection supposedly benign, in which the existence of cancer, though perhaps suspected, cannot be certainly diagnosticated before operation.

3. In cases of gastric carcinoma moderately advanced gastroenterostomy should be preferred to partial gastrectomy.

4. When the indication is to prevent starvation, jejunostomy should be performed.

HYDROCEPHALUS COMPLICATING EPIDEMIC CEREBROSPINAL MENINGITIS.

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Hydrocephalus complicating or occurring with acute cerebrospinal fever is of the greatest practical and clinical importance. It has been observed since the disease has been recognized. In modern times a description of it begins with Foerster, in 1883, but a more extended consideration is given it by von Ziemssen and Hesse. These authors, in describing an epidemic of cerebrospinal meningitis, with autopsies, record cases of associated hydrocephalus in which the duration of the disease was comparatively short, from eight to nine days, and in which autopsy showed a dilatation of the ventricles with purulent content. Other cases with autopsies are recorded by these authors, in which the disease had a protracted course, from seventeen days in one case, to ten weeks in another, and in which autopsy revealed dilated ventricles of the brain filled with purulent content. Cases were observed in young children as well as in adults. A classical, clinical analysis of their cases showed that the hydrocephalus was accompanied by headache, vomiting, unconsciousness, and convulsions, and that this symptom-complex in some cases remitted, to return at irregular intervals.

Von Ziemssen[1] lays particular stress on the paroxysmal nature of the symptoms which accompany hydrocephalus complicating

[1] Handbook of Infectious Diseases, vol. ii.

cerebrospinal fever. They consist of paroxysms of headache, pain in the neck, vomiting, unconsciousness, and convulsions. Hart[2] gives the clinical history and autopsies of cases of cerebrospinal meningitis in which he mentions the autopsy finding of dilatation of the ventricle. Otherwise he does not speak at length of the condition. Some of his cases, however, showed trismus and dilated pupils in the later stages of the disease. Heubner[3] takes up the subject of hydrocephalus occurring in cerebrospinal fever, but in a very terse and limited manner. Recent publications on cerebrospinal fever make very little note of this, it seems to me, most important condition. From my study of the condition I am convinced that our therapy must be guided to a certain extent by an early recognition of this most important state of the brain in this disease.

There are three distinct conditions under which dilatation of the ventricle, or hydrocephalus of an acute nature, may occur in cerebrospinal meningitis of the epidemic type. I refer more especially to the meningococcic epidemic form.

Clinically the most important form of acute distention of the ventricles—we may call it acute temporary hydrocephalus—is that which occurs at the very onset of the disease. It does not occur in every case, but in the cases in which it does occur an early recognition of its presence, I am convinced, is the means of saving the life of the patient. I may illustrate more forcibly the point of my argument with a definite clinical case.

Case I.—A child, aged five years, was taken with a slight sore throat, a high febrile movement, and vomiting. The fever continued for twenty-four hours; there was some headache, but not to an extraordinary degree. He was sitting up in bed and playing with his toys; suddenly, without warning, he became pale, the pulse rapid and feeble, the temperature rose, after having been previously depressed, to 105°, the surface became cool, the child lay back in a collapsed condition, with shallow breathing, rapid, feeble pulse, becoming quickly unconscious, and in this condition was seen by the attending physician. I had the privilege of seeing this patient. I found a child of delicate nutrition, unconscious, with sighing, labored respiration, rapid, feeble pulse, surface cold and clammy, with a very few minute petechiæ on the inner sides of the thighs and arms, scarcely noticeable, pupils dilated; percussion of the skull on either side giving a hollow, tympanitic sound, which has been described by Macewen as evidence of distention of the ventricles by fluid. The pulse in this case was 150, the respiration sighing and irregular. The diagnosis of distention of the ventricles by fluid thirty hours after the onset of cerebrospinal fever was made.

[2] St. Bartholomew's Hospital Reports, 1876.
[3] Eulenburg's Encyclopädie.

Lumbar puncture in this case confirmed two facts: First, that the case was really one of cerebrospinal fever of the meningococcic type; and, second, that the fluid in the subarachnoid space was under great pressure, fully 50 c.c. being withdrawn before the pressure seemed normal. The pressure was not measured, inasmuch as the manometer was not at hand. After the puncture the conditions of collapse, cardiac depression, and cerebral prostration improved; after days the mental condition cleared up and the patient made an uncomplicated and speedy recovery.

Another example of this form of acute distention of the ventricles threatening life, seen by me lately in conference with the attending physician, was the following:

CASE II.—The patient was a male child, aged two years and three months. Thirty-six hours before the onset of the symptoms the patient was perfectly well, playing around the house. The child was taken with a high febrile movement, vomiting and headache, being intelligent enough to complain. It rapidly became more stupid and when seen by me was in the following condition: It lay completely prostrated, pale in the face, and the lips blue. The pulse was rapid, 130 odd, very feeble in one arm and at the other wrist not to be left. The child could be roused, but rapidly sank again into a stupor. There was great hyperesthesia and slight rigidity of the neck, and petechiæ over the body. Percussion of the skull revealed a tympanitic note, as described by Macewen, on both sides, demonstrating a distention of the ventricles with fluid. Pupils dilated, no paralysis, no Kernig sign, no Babinski sign. Lumbar puncture made forty hours after the onset of the disease, revealed a fluid of milky turbidity, containing Diplococcus meningitidis, and evacuated under great pressure, continuing to flow to the extent of 40 c.c. before the pressure became normal. In this case, also, after puncture the pulse recovered tonicity, the sensorium became brighter, the child no longer exhibited attacks of collapse; once or twice after the puncture it vomited. The sensorium became progressively clearer until complete consciousness returned, within twenty-four hours.

In these cases the collapse, added to the distention of the ventricles, may be so great that, as in the first case, the paralysis seems to be almost complete. In very severe cases the typical symptoms met in the course of the meningitis, and which in these cases, reappear after the distention of the ventricles is relieved, may be absent. I refer to neck rigidity and Kernig's sign or opisthotonos. In the first case the patient was distinctly limp, and the collapse and prostration were so great as to resemble very closely what is seen in apoplexy and internal hemorrhage. In the second case, however, there was some rigidity and considerable reaction to irritation, a hyperesthesia which was absent in the first case.

CASE III.—Female, aged five years. The child had measles when one year old, and whooping-cough when two years old. Otherwise the general health had been good. The present illness began suddenly on March 16, 1906, with severe frontal headache and vomiting. The vomiting was repeated several times, was induced by food and drink, and was not projectile in character. There was slight fever on the evening of the first day, but no chills or sweats. The mother noticed no twitchings, convulsions, or palsies; but did notice stiffness of the neck on the following morning. The child refused nourishment, and was constipated.

On admission to the hospital on March 17 (at the end of thirty hours) the following notes were made: The child is prostrated, cyanosed, stuporous, apathetic, hyperesthetic, and irritable at times. She moans continuously, and grinds her teeth. The knees are drawn up; the head is not retracted. The left pupil is larger than the right; both react to light. There is internal strabismus of the right eye; ptosis of the left lid. No hippus. Mydriasis on flexion of the neck. Slight injection of the conjunctiva, and slight discharge. There is left facial paralysis; and tenderness over the tragi. Slight rigidity of the neck. Bilateral Macewen sign. There is general enlargement of the lymph nodes, especially of the cervical. There is a rapidly appearing tache on the skin, and a few minute rose-colored spots on the abdomen and back, resembling insect bites. The breathing is rapid, shallow, and irregular. There are numerous coarse rales throughout the chest and showers of subcrepitant rales at the end of inspiration in the interscapular regions. The heart is normal. The patellar reflexes are not obtained. The abdominal reflexes are equal and active. Kernig sign with dorsal flexion on both sides at 180°. No clonus. There is involuntary discharge of the urine and feces. There is a leukocytosis of 26,000. Lumbar puncture was performed, 25 c.c. of turbid fluid being obtained. The pressure at the beginning was 40 cm., at the end 3 cm.

March 19. General condition is much improved since lumbar puncture. She has no headache and no pain, and is propped up in bed. Pupils are of medium size and react normally. There is still a purulent discharge from the right conjunctiva, and a slight internal strabismus of the right eye. Flexion of the neck is still tender and causes slight mydriasis. There is no longer ptosis of the left lid, but there is still slight weakness of left side of face. Macewen percussion note is still present. Numerous coarse rales are still present in both lungs. Breathing is almost regular. There is a delayed tache. Knee-jerks active. Babinski is present on both sides. There is no Kernig sign, but there is dorsal flexion of the great toe at 180°.

21*st* (sixth day). General condition is improved. Patient is intelligent as well as conscious. She says she feels no pain.

The head is held slightly retracted. The child continued to improve. Recovery was complete by April 15.

This form of acute distention of the ventricles, or acute hydrocephalus at the outset of the disease, does not occur in all cases of cerebrospinal fever, but when it does occur it is an important condition to recognize, for its continuance may mean the fatal issue of the case, or an unfavorable modification of its course. In this respect, it seems to me, modern clinical methods are enabled to point the way clearly to therapeutic interference—that is, the relief of the distention. In these cases there seems to be no permanent injury to the brain, if the patient recovers, as a result of the enormous pressure which has been exerted upon the ventricle walls. I may call this condition acute hydrocephalic distention of the ventricles of the brain by exudate in the initial stage of cerebrospinal fever.

The second form of hydrocephalus, which was at one time, and in some of the text-books on neurology today is, thought to be the peculiar and only form occurring in children, is that which occurs in the course of cerebrospinal fever, attacking infants below two years of age. In a paper which I published last year on posterior-basic meningitis I illustrated this form of hydrocephalus and remarked that it is the most frequent outcome of cerebrospinal fever in young infants and children, occurring in that form of meningitis of the cerebrospinal type which attacks the structures at the base of the brain in its posterior half. This form of hydrocephalus does not necessarily occur at the outset of the disease, but may supervene after the disease has lasted some time.

The symptomatology of this form of hydrocephalus is very difficult to separate at the outset from the symptom complex of meningitis proper. In infants attacked with meningitis the exudate in the ventricles seems to find room and the ventricles readily expand, especially if the child is below one year of age, on account of the condition of the skull, the sutures, and the fontanels. The result is that tension in the ventricles is not so apparent in early life as it is later, when the sutures and fontanels are closed.

Percussion of the skullcap in these cases does not give the tympanitic note referred to in the first set of cases, but rather gives the impression of a sac with fluctuating fluid contents.

Lumbar puncture relieves the pressure in these cases, as is indicated by the collapse of the bulging fontanel, but the fluid soon reaccumulates and symptoms, such as unconsciousness, convulsions rigidity, soon return. In other words, there is no restraint, it seems, upon the re-accumulation of fluid.

In children of a later period of life, from one and a half to two and a half years of age, the fontanels and the sutures being closed, the Macewen tympanitic note may be obtained in the course of the disease when the hydrocephalus occurs. And even in these

cases it seems that the brain tissue is still so soft and resilient that reaccumulation of fluid easily occurs in a great number of cases. In a word, hydrocephalus occurring in the course of meningitis and not at the outset, in infants and children, is the natural sequence of the disease in a large majority of cases.

A third clinical form of internal hydrocephalus occurring in cerebrospinal fever is that which has already been referred to and which has been described by older writers. It may occur in any period of the disease after the first week. The patients usually are doing apparently well, they may have recovered from the severity of the onset of the disease, and may not, at any time, have been unconscious. There may be an intermittent febrile movement, the temperature at times being quite high, 104° or 105°, or even higher, falling within a few hours to the normal or subnormal, to rise again after a few hours to the original height. A patient running this intermittent or even irregular type of fever may be progressing favorably; that is, although complaining of headache, the child may be conscious, it does not vomit, and the headache, though severe, is mostly of the occipital type. Gradually the patient becomes stupid; there is vomiting and an increase of rigidity; the patient still may answer questions and answer them rationally. If, at this stage, percussion of the skull is carried out, as I have described, a slight tympanitic note may be heard over the ventricles, on one or both sides. This is the first indication that a distention of the ventricles with exudate is becoming extreme and that a hydrocephalus is forming. Relief at this stage of the symptoms may mean the saving of the patient, and overlooking the symptoms may do irreparable damage. Such a case is the following:

Case IV.—A boy, aged nine years, was taken with the typical symptoms of cerebrospinal fever of a moderately severe type. He had been perfectly well previously, had partaken of some indigestible food, complained of headache, and vomited once. He then developed rigidity and other symptoms of cerebrospinal fever, and began to run a temperature which ranged at the outset from 102° to 105° or 105.5°, with daily remissions to the normal or subnormal, a curve very closely resembling a typhoid fever in the third week. This boy, being highly intelligent, was conscious during the whole course of the disease up to a certain period. On the twentieth day of the affection, when he vomited for the first time, the headache, which had been quite severe and had been accompanied by pain in the abdomen of a very severe type, became still more insufferable. Chilly sensations were present. The intervals of consciousness and rationality became less frequent, he passed gradually into a state of sopor, having been quite conscious twelve hours previously.

Percussion of the skullcap revealed a tympanitic note on the left side, showing distention of the ventricles. Puncture in this case revealed a slightly turbid fluid under very great pressure.

falling to the normal only when 40 c.c. had been removed. After the relief of the distention of the ventricles the patient became quite bright, although talking constantly. He took nourishment, still complained of headache and pain in the ears, but was more rational. The improvement was steady, the pain and headache diminished day by day, the temperature fell to the normal, and the patient made an uncomplicated recovery.

It seems from a study of the temperature chart that apparently—and this patient was watched very closely—the correct moment was chosen to relieve pressure, for after the puncture the temperature rose to its highest, 105.5°, then fell to the subnormal, and rose to the normal and remained there until complete convalescence. Before the relief of the pressure the pulse was not only irregular but high; it became slower and more regular after relief of the hydrocephalus or acute distention.

The histories of cases illustrative of this type, in which recovery takes place, are given here simply to emphasize how early and closely these cases may be diagnosed, although it must be confessed that not in all cases is the outcome so fortunate. It is in these very cases of prolonged course that von Ziemssen has shown how hopeless is the outcome in a great many instances.

Of especial interest are the very mild cases of cerebrospinal meningitis in which the symptoms of the disease are so equivocal as to mislead even a careful observer. Such patients may make apparent complete recovery from an initial attack and after an interval of a month develop symptoms of meningitis of a severe type, with acute internal hydrocephalus superadded from the outset. Such a case was recently under my care, the history of which is as follows:

CASE V.—Admitted with an initial attack of cerebrospinal meningitis of three weeks' duration. On admission there was no indication of distention of the ventricles. Active symptoms subsided two days after admission, temperature remained normal for ten days, when he was discharged cured apparently. Readmitted with a history of freedom from symptoms for forty days, when there was a recrudescence of symptoms of cerebrospinal meningitis, with signs of mild and then increasing hydrocephalus. In spite of repeated puncture there was no relief of symptoms, and death resulted from inanition.

CASE VI.—A male, aged seven and a half years, was admitted with signs of distention of the lateral ventricles on the fourth day of the disease. The symptoms of acute hydrocephalus were relieved. There was a return of the symptoms of hydrocephalus on the twenty-third day of the disease, as evinced by exacerbation of headache, dilated pupils, sopor, vacant expression to face, hyperesthesia, and vomiting, with Macewen percussion note over the ventricles of the brain. Remission occurred and then exacerbation

of symptoms on up to the fortieth day of the disease. Death occurred on the forty-first day. Temperature was normal from the thirtieth day of the disease, at times subnormal. The postmortem revealed chronic hydrocephalus, marked dilatation of the lateral ventricles, and marked distention of the iter.

In this case postmortem there evidently was no obstruction to the escape of fluid from the ventricles; this could not be a cause of the hydrocephalus.

Case VII.—Female, aged three years seven months, admitted March 8, 1906. The child was always strong and healthy. The present illness was of twenty-four days' duration. The onset was sudden, commencing with headache; later vomiting. Fever from the onset. Headache lasted for a few hours; followed by deep stupor. Remained stuporous for four days. Then lumbar puncture was performed; following this she regained consciousness. Mind was clear until two days ago, when stupor developed again, and condition has not changed since. Vomited the first day. Father does not know if it ever was projectile in character. Vomited usually after food or medicine. Has not vomited since the first day. Fever was very high, 105°, first day; very irregular in type. Temperature more moderate lately than it has been. No history of any chill, sweats, or convulsions. No grinding of teeth. Child lies with mouth open all the time. No twitchings or convulsions. General muscular rigidity, particularly at the neck and knees since onset. Has not been delirious since day of onset. Very irritable and hyperesthetic all the time. Hearing somewhat impaired for the last two days. Takes nourishment well. Sleeps fairly well at night, occasionally requires bromides. No history of night shrieks. Bowels at first constipated. For two weeks until two days ago, five to six watery movements daily. No mucus or blood (one drop of blood on one occasion). Odor bad. Was getting potassium iodide and bromide. Medication then stopped and bowels improved. No vomiting at the time. Had a rash on the body at this time, large patches, general urticaria. No eruption at the onset of the disease. Urination: increased frequency and amount. Has had loss of control of the rectal and vesical sphincters. During the first week there was weakness of left arm and left leg for a few days. Not since. Patient has had periods of improvement during present illness. Child sat up in bed and sang and played, although some temperature persisted. Condition much worse for past two days. Child hears and sees. Lumbar puncture was performed three weeks ago. 30 c.c. of turbid fluid was obtained.

Chief complaints: Restlessness, irritability, fever, rigidity of the neck, and flexion of the knees.

Physical Examination. General condition, fair. Patient is fairly well nourished, looks sick. Lies on right side, with knees drawn up. Is stuporous, irritable when touched, and vicious.

The neck is rigid. No mydriasis on flexion. Marked Macewen sign, bilateral. The pupils are equal, moderately dilated. Right and left internal strabismus. Conjunctivæ negative. Left facial paresis. The skin is hot and sensitive to touch. There is a tache. The heart and the lungs are normal. The knee-jerks are not obtained. Bilateral Babinski sign. Kernig sign, with dorsal flexion, on both sides, 180°. No clonus.

March 9. Both ear-drums slightly reddened. Leukocytosis of 20,000. Lumbar puncture performed on account of restlessness and presence of Macewen sign. Puncture was made in fourth space. 30 c.c. of slightly turbid fluid obtained. At beginning pressure was 25 mm.; at end pressure was 3 mm. Depth of introduction 3 cm.

10*th*. Restlessness the same. Macewen still present.

14*th*. Blood. Leukocytes, 18,000. Hemoglobin, 78 per cent.

15*th*. Child is irritable. There is internal strabismus of left eye. There are occasional involuntary discharges of urine and feces. Child looks worse. Neck is slightly retracted, fever continues. There is a Macewen sign present. Neck is rigid. There is mydriasis on flexion of neck. Breathing is irregular and cerebral in type. Pulse is irregular. There is a Kernig sign on right side and on left side with dorsal flexion of 165°. There is a bilateral Babinski sign.

16*th*. Lumbar puncture. Needle introduced 2.9 cm. Pressure (initial) was 22 mm.; final pressure oscillated between 7.5 and 15 mm. About 20 c.c. of a slightly turbid fluid was withdrawn.

April 16. Child has steadily improved, sits up, sings and plays with children, though she has signs of a persistent hydrocephalus. Her nutrition also has improved.

These are cases to which the older writers referred as being of discouraging prognosis. The symptoms of hydrocephalus are progressive under every treatment, and are accompanied by extreme emaciation, clouding of the intellect, symptoms of encephalitis, such as paresis of the facial muscles and extremities, volitional tremors, vomiting, and convulsions.

One of the principal symptoms which is striking in subacute meningitis in which hydrocephalus supervenes is the progressive emaciation, in spite of nourishment which is sufficient to maintain nutrition. These patients will take large amounts of nourishment and will emaciate progressively in spite of the food elements which are retained in the body. Emaciation in these cases differs from the emaciation which is seen in the course of any acute disease, or in the course of favorable cases of cerebrospinal meningitis, in that it is extreme and seems to me to be of a trophic nature.

Toward the latter end of these cases of hydrocephalus the patients

develop symptoms of encephalitis, such as paresis of the ocular and facial muscles and those of the extremities, and, what is especially noteworthy, volitional tremors of the muscles of the face, jaw, and extremities.

From what has been said there has been an indication that with the symptoms of meningitis a condition of hydrocephalus yields a distinct symptom complex. Given a case of meningitis in the course of which, after the initial stage has passed, the patient is improving gradually as to his sensorium, the temperature is falling, as in one of the cases related, there is a dulling of the intellect, vomiting, dilatation of the pupils, strabismus, a vacant stare to the expression, sometimes even in older children, a depression of the eyes, showing the sclera—in such cases the hydrocephalus seems to have been well inaugurated.

The early symptoms are those indicated by percussion of the skull. A patient who is apparently doing well, who may have had a normal temperature, will develop an ephemeral rise of temperature, sopor, headache, and vomiting, and percussion of the skullcap, very early in the disease, will reveal a tympanitic note, showing not only dilatation of the ventricle but an accumulation of fluid within. This I consider one of the most useful guides in the subacute cases of meningitis in which there is threatened or well-established hydrocephalus. Today we need not wait until even the tyro can diagnose an accumulation of fluid in the ventricle in acute cases, but by the aid of percussion of the skull and the study of the symptoms we can diagnose the condition quite early.

A symptom of moment is vomiting. Vomiting in the course of meningitis of the subacute type is a very ominous symptom, especially if repeated and if it occurs independently of the ingestion of food, that is, at the moment after the food is taken into the stomach.

Dilatation of the pupils and strabismus, especially in younger children, are other symptoms. The pulse in all cases of hydrocephalus is irregular, both in rhythm and force. It was formerly thought that hydrocephalus could occur only with a normal or subnormal temperature, but a study of temperature curves shows that hydrocephalus may occur with an intermittent high temperature, which intermits to the subnormal daily; or it may supervene in a patient whose temperature is normal; or when once inaugurated, the temperature may run an intermittent subnormal course.

Of especial interest in relation to early dilatation or acute distention of the ventricles is the effect of extreme pressure on the pulse and respiration. In those cases in which the hydrocephalus supervenes at the onset of the disease the patient goes into a condition of collapse, the pulse may be rapid and thready, the surface is cold and ashy in hue, the pupils are dilated, respiration is sighing in character, the patient exhibiting all the symptoms of cardiac collapse. It is wonderful to what extent the ventricles of the brain

may be distended and still the patient rally from the symptoms, showing in the recovery no signs, so far as percussion of the skull or the mental state are concerned, of the previous great, and what must have been life-threatening, pressure.

Of interest also are those cases in which, in the course of the disease, when the symptoms are improving, there is a development of all the symptoms of hydrocephalus of the mildest type, as shown by percussion of the skull, the intervening sopor, dulness of intellect, irregularity of pulse, and the rapid recovery of the patient after interference. I have no explanation to offer as to why these patients do not continue to develop the symptoms of fully developed hydrocephalus, and why an exudate which suddenly threatens to increase should cease at a certain point and leave no marks or ill-effects of the distention.

Methods of Diagnosis. I have referred quite frequently to percussion of the skullcap and its utility as a means of early diagnosis of hydrocephalus supervening either at the outset or in the course of meningitis. I have followed the method of percussion through two epidemics of cerebrospinal meningitis and I am convinced that its more general adoption will lead to better results in the early diagnosis of this symptom complex than has been hitherto possible. Macewen was the first to point out, in conditions other than meningitis, the utility of percussing the skullcap in the diagnosis of hydrocephalic effusion into the ventricles of the brain. Children at the age at which the ventricles and sutures are not yet closed, as already referred to, do not lend themselves to this method of diagnosis of hydrocephalus, but in children and adults in whom the sutures are ossified and the skull fully formed, utilization of the Macewen percussion of the skull in the course of meningitis will enable one to detect at a very early stage a hydrocephalic effusion into the ventricles. In some cases, as in some of the histories subjoined, we may be able to detect that the effusion is unilateral at first and then may become bilateral. At times percussion of the skullcap will reveal effusion in the ventricle, and after an interval of a few days this percussion note may not be so indicative of effusion—that is, it may not be so tympanitic, then may return to the tympanitic note after a day or more. The cause of this I am unable to explain. It is simply a clinical observation.

A word may be said here as to the cause of hydrocephalus in cases of cerebrospinal meningitis. Joslin, in an article on internal hydrocephalus complicating cerebrospinal meningitis, gives the autopsy findings in one case of his own and in a number of others, in which there was an occlusion of the foramen of Magendie or Mierjewski, or a matting together of the structures at the base of the brain, thus preventing the escape of the fluid, either transudate or exudate, from the ventricles through the foramen of Monro and then of Magendie to the subarachnoid space. In a paper on

posterior-basic meningitis which I published in 1905, I related one case of posterior-basic meningitis in which this foramen was also closed. Whereas, in some cases of hydrocephalus the mechanical closure by exudate of this foramen may explain the retention of fluid in the ventricles, it certainly does not explain why hydrocephalus occurs in these cases, for in the vast majority of cases of hydrocephalus which I have observed a lumbar puncture by a skilled hand could withdraw large amounts of fluid from the subarachnoid space, which argues against the existence of any obstruction of the foramina mentioned. In fact, I am inclined to believe that the closure of these foramina is an exceptional and accidental finding in a few cases, and that in most cases of hydrocephalus the cause of the hydrocephalus lies in the inflammatory changes in the bloodvessels and lining structures of the ventricles of the brain, for in no other way could we explain the acute cases at the very onset of the disease, and the subacute and chronic cases both in young and older children and adults, in which it is an easy matter to remove large quantities of fluid from the subarachnoid space and ventricles by lumbar puncture.

In those cases which have run a subacute or chronic course and in which internal hydrocephalus exists and the foramen of Magendie is either narrowed or closed, lumbar puncture will succeed in evacuating 10 or 15 c.c. of clear fluid under little or no pressure. In other words, the fluid flows drop by drop and ceases to flow after a time, uninfluenced by the cries of the patient or by respiration. In other cases in which the canal of Magendie is closed the puncture will evacuate but a few drops of clear fluid. In such cases it is not difficult to see that the hydrocephalus must not only persist, but its disappearance becomes impossible.

THERAPY. It is but proper to consider here, if only in a few words, the question as to whether we have succeeded in curing directly or indirectly by therapy any of the forms of hydrocephalus mentioned in this paper. In considering the question of therapy I have in mind only the procedure of lumbar puncture. In those cases which have been described in this paper in which hydrocephalus supervenes at the outset of cerebrospinal meningitis, lumbar puncture has seemed to me to be a procedure of great utility, not only in relieving the pressure and therefore preventing irreparable damage to so delicate a structure as the brain, but, in very severe cases, by relieving the pressure we relieve a set of collapse symptoms which, if allowed to continue, certainly are not devoid of danger to life.

In those cases in which an early diagnosis is able to detect threatened hydrocephalus in the course of the affection, in the second or third week of the disease, a single lumbar puncture has, in some instances, been sufficient not only to relieve the symptoms which were evidently caused by increasing fluid in the ventricles, but to

arrest the progress of the disease at a critical moment by the removal of the excess of toxins or bacteria from the interior of the cranial cavity.

It is, of course, difficult to say in those cases in which a marked improvement has followed a single lumbar puncture, how much influence this one procedure had in arresting the disease. I have given a demonstration in this paper of some such cases, and I leave it for future investigation to prove whether there is any proof in this supposition. If the hydrocephalus, after a primary puncture becomes progressive, as in subacute cases, and there is a continued rise and fall of temperature, or even a normal temperature and continuance of vomiting, with headache, Macewen's sign—showing re-accumulation of fluid in the ventricles—dilalation of the pupils, extreme emaciation, and in time signs of encephalitis, such as volitional tremors and paresis, it has seemed to me that lumbar puncture has been of very little avail in a curative sense. What lumbar puncture fails in doing in these cases it possibly succeeds brilliantly in doing in other cases.

It is but proper to say that the studies which have given origin to this paper seem to me to have definitely fixed the indication for the procedure of lumbar puncture in cerebrospinal meningitis of the acute type. The indications hitherto for the performance of this operation have been exceedingly vague. Lenhartz[4] speaks of repeated lumbar puncture as a routine procedure in cerebrospinal meningitis. Netter, in the early history of the disease, was one of the first to insist on the utility of applying this routine procedure. I even went so far as to publish several cases in which I thought I had cured a series of cases by repeated lumbar puncture. More mature study and experience have taught me that the indiscriminate application of lumbar puncture to the treatment of acute cerebrospinal meningitis is of as little utility in itself as a curative measure and as productive of harm as would be the indiscriminate use of any therapeutic procedure. Lumbar puncture should not be performed with a view to evacuating purulent or semipurulent contents from the cerebrospinal spaces, for in most cases this of itself does not cure the case. It should also not be performed for severe headache, fever, or unconsciousness, and, it seems to me, only in fixed cases should it be performed for diagnostic purposes.

It should not be difficult to make the diagnosis of cerebrospinal meningitis of the acute type without resorting to lumbar puncture. Today lumbar puncture is not resorted to by me except on a definite indication which crystallizes itself into the principle that the chief element of mischief in cerebrospinal meningitis is the accumulation of fluid in the ventricles of the brain, their distention by this fluid, and the evil effects of the pressure of the infected fluid on such a

[4] Münch. med. Woch., 1905.

large surface of so delicate a structure as the brain substance. I have seen numbers of patients with meningitis recover without lumbar puncture being resorted to. These patients were simply nursed, fed, and given drugs according to the indication of the case; they recovered without a sign or symptom of the evil effects of the meningitis, unless it were in certain cases in which at the outset of the disease deafness or an iridochoroiditis developed, fatal to the ear or eye. In the recent epidemics in New York the recovery of patients who have been treated without lumbar puncture is tolerably complete and satisfactory.

I resort to lumbar puncture only at the outset of the disease, or in its course, when I am convinced that there is an accumulation of fluid in the ventricles; unless the signs which I have detailed in this paper are present, irrespective of headache, delirium, or high temperature, I do not puncture. I feel that such cases are not benefited by lumbar puncture, although I have punctured many simply to convince myself that everything available in human knowledge had been offered to the patient.

CARDIOVASCULAR REGULATION DURING AND AFTER OPERATION.

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A series of observations extending over four years in abnormal cardiovascular cases, with special view to the added light that accurate estimations of blood pressure throw on the results of previous methods of examination, has apparently developed some important medical questions, detailed and published elsewhere. But, in addition, another part of the work, perhaps more than half, being occupied with surgical cases, has seemed to bring out even more important possibilities. These observations were conducted in the general surgical, gynecological, and obstetrical wards of the Johns Hopkins Hospital, Baltimore, and in the Memorial Hospital, Richmond; they embrace observations before and during operation and throughout convalescence, varying through a variety of cases, those presenting some unusual or serious feature engaging special attention. I wish particularly to express my gratitude to Dr. George Ben Johnston, of Richmond, Va., for the privilege of observing his cases.

Obviously the preservation and proper regulation of the cardiovascular system is of pre-eminent importance in the successful conduct of any surgical case of more than the most trivial nature, and most fortunately it now lends itself to the closest scrutiny of

any system and presents the fullest possibilities of accurate distinctions.

An estimation of renal capability must be of the vaguest nature, and postoperative suppression gives no good warning; nor can we foresee the lack of intestinal tone which may determine a postoperative ileus, or the presence of such gastric irritability which may induce fatal vomiting. The cardiovascular system, the most important, is fortunately the most accessible. An educated touch for arterial changes, percussion skill to outline cardiac dulness, the pulse rate and quality, but above all the accurate estimation of pulse strength, furnish data which, when properly correlated and interpreted, by correct premises and the experience of repeated observation, have a value which should hardly be put of second importance to a correct diagnosis of the local surgical condition. Of little value to the patient, however scientifically satisfactory, is a correct differential diagnosis between myoma and carcinoma of the fundus of the uterus, if the cardiac strength or vascular strain has been mistaken or slighted, and the patient dies of acute cardiac dilatation on the table or during the first few days after the operation.

The deductions herewith presented are not built on the occasional observation which, as in those hospitals where blood-pressure records are taken at all, may be made every twenty-four hours, or before and after operation; in these cases the observations were made at frequent intervals and continuously, and always by the same person, or my friend Dr. Briggs, who worked with me at the Johns Hopkins Hospital. As we were accustomed to observe cases alternately and found our observations constantly agreeing, the error of personal equation was minimal. Usually during operation the pressure determination would be made every two and a half minutes and continued as frequently, sometimes forty-eight hours after the operation. In some cases when rapid variation was noted, one-half minute observations were recorded. The observations were always charted, as originally recommended by Cushing, so that the variations were most graphic. The blood-pressure observations were always correlated with the other vascular and general symptoms, particularly the area of cardiac dulness, quality and rate of the pulse, character of the arterial wall, facial aspect, and subjective symptoms. In the earlier cases the narrow (5 cm.) band originally made with my instrument was used; in the latter cases the wide arm-piece was used. The narrow arm-piece gave too high absolute readings, but the degrees of variation were quite comparable. I continue to use my modified Riva Rocci apparatus made in portable form for greater convenience in general practice. The same instrument in continuous use for three years remains perfectly satisfactory.

The cases showing abnormal blood pressure naturally divide themselves into two main groups: (1) Those with an increase in

tension, and (2) those with a low tension. Besides these there is a third miscellaneous group of abnormal cardiovascular cases with normal blood pressure, representing in general the moderate grades of failing compensation. For instance, a well-compensated valvular insufficiency or arteriosclerosis may show a systolic pressure of 180 mm. Hg., but as the heart begins to fail the tension falls and may be found normal at some point along the progressive downward course. This condition necessarily must be recognized by signs other than the absolute blood pressure, and should be suspected when, without a murmur or hypertension, the heart outline is enlarged, showing weakening and stretching of the muscle, or the general condition and appearance indicate failing strength, especially if the arterial wall shows thickening and bending, such as might have been produced by a preëxisting chronic hypertension, or if the pulse is irregular in force or rhythm or accelerated. Such cases demand especial care to minimize the strain on an already failing heart; yet, as they usually show no murmur and often no irregularity of pulse, and have a clear urine (though albumin might have been found some time previously during the initial period of hypertension), they go to operation unguardedly.

In general, the tendencies of the high and the low-tension cases correspond to the similar cases in medical conditions. The high-tension cases stand the added strain of ether anesthesia and operative manipulation poorly and tend to suffer cardiac dilatation, excessive hemorrhage, vessel rupture, or renal affections, while if they survive the immediate effects of the operation the convalescence is ordinarily favorable. When, however, high tension persists after operation, it should be watched closely for some weeks, and treatment should be instituted to lessen the strain on the heart and blood-vessels. This would give us the necessary clue to those unfortunate patients who apparently recover promptly from operations only to suffer from acute cardiac dilatation and sudden death or cerebral rupture from a few days to several months afterward.

The low-tension cases conversely, in general, stand the operation well if chloroform be not used, if hemorrhage be not excessive, nor peripheral irritation extreme; yet, as has also been found from a medical point of view by the incidence of tuberculous tendency in low-tension individuals, these subjects show a lowered resistance to infectious disease and are subject to pneumonia or local infection.

The general rationale of prophylactic and corrective treatment in these cases follows naturally, after their recognition, from an application of such measures as tend to counteract the existing condition and the avoidance of those procedures that would exaggerate it. Thus, when abnormal hypertension exists prior to operation, a preliminary reduction of the tension should be accomplished, which reduction should be maintained at least through the first part of the operation and throughout when hemorrhage cannot be

easily controlled, as the tendency to hemorrhage is, of course (coagulation time being constant), in direct proportion to blood pressure. This reduction in tension can be easily and equably accomplished, in the majority of cases, by the exhibition of sodium nitrite, the vasodilator which has proved preferable in my experience.

Sodium nitrite is usually dispensed only as crystals or in solution. Three to five drops of a saturated solution is usually a satisfactory initial dose. Tablets of $\frac{1}{2}$ grain and 1 grain have proved more satisfactory than the solution; they seem very stable, as I am now using some a year old which have unimpaired effect in lowering tension. They may be used hypodermically or by the mouth.

Throughout operation these patients need careful watching; the Trendelenburg positions should be assumed only when absolutely necessary, and then moderately, the hypertensive tendency of asphyxia being avoided as much as possible by a free supply of air or even oxygen with the anesthetic, and care taken not to embarrass further the overtaxed heart in an abdominal operation by stuffing more gauze than is absolutely necessary under the diaphragm. If the pulse, which is usually slow in these cases, becomes much accelerated without a corresponding increase in tension, an attempt should be made, if possible, to see if the heart is dilating.

I have records of 10 cases of acute dilatation of the heart in hypertension cases, in 5 of which death resulted on the table or within the next forty-eight hours. In 1 of the 3 patients that lived the heart at a tension of 180 mm. dilated in three-quarters of an hour, the pulse jumped to 160, and the operation for carcinoma of the cervix was abandoned. This woman was hurried from the table with a clinical diagnosis of shock, yet the pulse tension was still 180 and the heart waving a wide impulse outside the nipple line. Although the woman ultimately died of the growth, the vasomotor condition at operation precluded the possibility of cure. Nitrite would have probably corrected this sufficiently to have permitted completion of the operation. The hemorrhage also in this case was almost uncontrollable and would certainly have been bettered by a reduction in tension. The other cases were similar, though varying in details.

A patient with arteriosclerosis and an anteoperative blood pressure of 190 mm. Hg. left the table, after a Gasserian operation had been abandoned on account of uncontrollable hemorrhage, with a hemiplegia on the same side as the opening in the skull, showing it was not from direct injury.

In these hypertension cases chloroform is not indicated, as has often been urged for arteriosclerosis, for, although chloroform does lower blood pressure, the same effect can be produced by the vasodilators without the marked inhibitory and toxic action of chloroform. The convalescence, as mentioned above, is usually uneventful unless a rapid return of very high tension induces cardiac

dilatation or secondary hemorrhage, the latter being especially dangerous if internal, of which consecutive blood-pressure observations afford the best indication.

Low-tension cases in general stand operation well, with proper precautions for the avoidance of shock and undue hemorrhage, and to the surprise of the anesthetist often leave the table with an improved pulse. This, in view of the hypertensive tendencies of operation and anesthesia, as just reviewed, is easily understood. Their low resistance, either dependent on the low tension or merely associated with it, may and should be corrected after operation by active stimulation to prevent the susceptibility to infection.

These low-tension cases seem to lack resistance to infection, and pneumonia, local abscess, thrombi, etc., seem to occur more frequently among them. Strychnine in repeated tonic doses, about $\frac{1}{40}$ grain for adults, is apparently most beneficial. The preliminary purging and fasting should be less stringent and nourishing food should be given as soon after operation as the gastric condition will permit.

That blood-pressure observations afford the earliest and surest indications of oncoming shock or excessive hemorrhage during operation can, I think, be no longer disputed. As consecutive blood-pressure observations during operations in serious or lengthy cases come into more general use, fewer cases of profound shock will develop under surgical manipulation. Pulse rate alone gives tardy and uncertain warning, and lessening tendency to hemorrhage, shallow respiration, and pallor are even more uncertain guides. A blood-pressure chart gives an accurate and graphic picture of vascular tone, and its value cannot be too greatly emphasized.

The few hours immediately following operation are fraught with many possibilities of dangerous turns and are often the most anxious ones. A study of the postoperative complications, in which the cardiovascular system plays the most important part, with the additional light of accurate knowledge of consecutive changes in pulse tension, affords a basis for classifying them into divisions which may materially aid their individual recognition. Usually the single symptom that is depended on to give warning or knowledge of a change in cardiovascular conditions is pulse rate, and a rise in rate or a rapid pulse is taken roughly to gauge the danger. Therefore (as detailed elsewhere, but yet unpublished) the divisions of tachycardia comprehend the majority of postoperative cardiovascular complications, and with the detailed association of other signs and symptoms may be briefly indicated as follows:

Hemorrhage. If hemorrhage is acute, the pulse rate does not usually rise to any marked degree until the loss of blood is excessive. It is not unusual to find a severe hemorrhage which has lowered the tension 75 per cent. in an hour, without raising the rate above 80. In slow hemorrhage extending over some days, as in some ruptured

extrauterine pregnancies, the rapid pulse seems not so much an indication of loss of blood as of cardiac weakness from the impoverished, diluted blood. In a slow hemorrhage the hemoglobin percentage and pulse rate are better indications than tension, while in rapid hemorrhage the falling tension is not only the first but often the only indication until the degree is extreme. The character of the pulse is often full and bounding, and the height of the wave which is increased by the lowered tension may readily give rise to a mistake in palpation judgment, the large impulse giving the impression of strength. The small, thready pulse, due to a compensatory effort of the vasomotor centre to raise the tension by peripheral constriction, is of later development, and the loss in blood volume may escape palpation judgment. Pallor and subnormal temperature are the rule, and later the characteristic subjective symptom of dizziness. The area of cardiac dulness is not increased.

Shock. The onset of shock may not occur until after the patient leaves the table, perhaps through continued chemical or mechanical irritation of the severed nerves, and may then be severe. As already mentioned for the period during operation, blood-pressure determinations afford the earliest and most valuable indications of this loss of vascular tone. The temperature is subnormal, and subjective symptoms, such as great restlessness and anxiety, are common. Severe shock may exist without rise in the pulse rate.

Infection. Bacterial infection usually causes a rise in pulse rate which in some cases may be alarming, and when the possibility exists may cause suspicion of one of the two conditions just mentioned, shock or hemorrhage. But the tension does not fall and may even rise in response to the increased rate. This is true of pulmonary infections excepting tuberculous and local pyogenic infection at the site of the wound. I have repeatedly seen abdominal cases in which hemorrhage or shock was feared from the rise in pulse-rate; yet the continued observation of normal or increased blood pressure excluded both. The rise in temperature corresponding to the rise in rate and without a fall in tension confirms the diagnosis of infection. Of course, the later septic form of temperature which sometimes accompanies anemia following hemorrhage must not be taken to mean infection.

Cardiac Dilatation. This condition is more infrequently recognized, I believe, than any other postoperative cardiovascular complication; yet it is by no means rare and is of serious import, and, further, when recognized, lends itself readily to corrective treatment. From the number of cases I have personally seen, ten in all, I believe many of these cases, all of which show tachycardia, are treated with a view to raising the tension with the idea that they are in shock, or suffering from excessive hemorrhage, or that the failing vascular tone needs bracing. As a matter of fact, the rapid pulse often occurring in stout individuals in whom accurate palpation judgments are

difficult, is mistaken for a weak pulse. Vasodilators are indicated, or *in extremis* even bleeding, and not the measures frequently used to increase the tension, such as the Trendelenburg positions, abdominal compression, adrenalin, caffeine, and saline transfusion. The registered pressure may be above 180 mm. Hg. Examination of the heart will reveal an increased area of dulness, especially to the left. The impulse, if visible or palpable, will be at or outside the nipple line, usually wide in area and wavy.

This paper is presented with a view of emphasizing the importance of giving more attention to the general condition of patients previous to operation and while the strain and shock of operative manipulation lasts, and to the value, during these periods, of blood-pressure observations, especially when controlled by other signs and symptoms. The recent advances in surgical methods and technique leave little to be desired along strictly operative lines, but still many patients go to operation with the old routine of a cursory auscultation for cardiac murmurs and urine analysis for albumin and sugar. During the operation, although excessive details of asepsis and technical surgical skill are observed, the general condition of the patient is merely followed as well as may be by the interne in what intervals he may find to feel hurriedly the pulse between filling his ether cone, swabbing out the mouth, and perhaps holding up a stubborn jaw. Yet the one-half to four hours of operation is the most severe and critical period in the lifetime of the patient, and likely to produce such variation above or below the normal pulse tension, as, taken in relation to the arterial and heart condition, may, on the one hand, determine arterial rupture or cardiac dilatation, or, on the other, respiratory failure in shock or hemorrhage.

After the operation a knowledge of these relations is of extreme importance in distinguishing and in guiding the treatment of certain postoperative complications, all of which may have the common and usually the only noted symptom of tachycardia; or when an anomalous slow pulse may give very deceptive indications when pulse-rate alone is studied. During that period of marked disturbance in cardiovascular routine it would appear that a more intimate medical knowledge, especially training in the observance of these surgical crises, would add much valuable light to the general aspect of the case, not interfering with but aiding and supplementing the strictly surgical procedure, and that every serious surgical case would be better off if given the benefit of accurate medical interpretation of cardiovascular indications. Such a course would have more far-reaching benefits than those immediately accruing to the individual patient, as it would tend more closely to cement and emphasize the natural relation which exists between medicine and surgery, and which finds truer expression in more extended co-operation.

CLINICAL STUDIES OF THE CEREBROSPINAL FLUID, WITH ESPECIAL REFERENCE TO PRESSURE, PROTEIN-CONTENT, AND THE NUMBER AND CHARACTER OF THE CELLS.

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(From the Medical Clinic of the Johns Hopkins Hospital.)

More than fifteen years have passed since Quincke first performed lumbar puncture, yet the full scope of the measure for diagnosis remains undefined. The bacteriological results are satisfying when positive; a frankly purulent fluid, or one that shows grossly an increase in cell content, is almost equally so; but when the fluid flows water-clear, without an evident spurting to suggest increased tension, when it is bacteriologically negative and without marked cellular increase, the conclusion usually reached is that matters in the subarachnoid space are as they should be.

Quincke[1] gave us lumbar puncture as a clinical method; Krönig defined the pressure under which the fluid is held normally, and many later writers have pointed out conditions under which this is increased; Guillain and Parant[2] identified the protein constituents and showed their variation in disease; and Widal, Sicard, and Ravaut[3] are responsible for cell formulæ which they have held as indicative of special meningeal conditions. Of late, Donath,[4] Mott,[5] and Halliburton[6] have laid stress on the presence of cholin in the fluid during the course of some degenerative nervous diseases, notably paresis. Apart from these real aids are a number less well established: chromodiagnosis, cryoscopy, electrochemical resistance, the permeability of the meninges for certain drugs, the toxicity of the fluid, and its glucose content.

At present, consistent methods of work with each specimen seem much more needed than the discovery of new attributes. Clinically, apart from the gross appearance of the few cubic centimeters drawn off, there are four determinations of special value: (1) The pressure in the subarachnoid space, (2) the protein content, (3) the cell content, and (4) the cell character of the fluid.

Toison and Lenoble stated, in 1891, that the normal cerebrospinal fluid holds a very few lymphocytes, but many later workers—Mott, Schlesinger,[7] Widal, Sicard, and Ravaut—have considered it to be free from cells, and today the point is still undecided. In 1901,

[1] Berl. klin. Woch., 1891, xxviii, 929.
[2] Rev. neurol., Paris, 1903, xi, 406.
[3] Ibid., Paris, 1903, 438.
[4] Ztschr. f. physiol. Chem., Strassb., xxxix.
[5] Brit. Med. Jour., London, 1904, i, 1554.
[6] Chemical Side of Nervous Activity, John Bale Sons and Danielssohn, London, 1901.
[7] Deut. med. Woch., 1904, xxx, 1022.

Widal, Sicard, and Ravaut noted a marked cell content in tuberculous meningitis; a little later Brissaud and Bernandet found numerous lymphocytes in tabes, Joffroy in paresis, and Sicard and Monod in syphilis of the central nervous system.

The method employed by these observers, namely, to judge of the presence and number of cells by examination of the sediment obtained on centrifugalization of the fluid, and determination of the cell number per oil-immersion field, has allowed such a large personal error that the satisfactory interpretation of statistics founded on it is impossible. Yet with but few exceptions the later workers have used it.

Laignal-Lavastine,[8] and a little later Joffroy and Mercier,[9] attempted exact quantitative counts, but the technique of the first is tedious, and we have no description of that of the others. In 1904, Fuchs and Rosenthal[10] presented a method whereby, with a weak aqueous solution of methyl violet and acetic acid, and a modified Zeiss counting chamber, a direct quantitative and differential count of the cells could, they asserted, be made. Kramer,[11] with this technique, and Simpson,[12] following nearly that of Laignal-Lavastine, have recently studied the spinal fluids of certain insane patients, most of them paretics.

The solution of Fuchs and Rosenthal greatly injures or destroys such red corpuscles as may be present, and, for reasons to be cited, these seem to be important in the count. I have, therefore, devised another method for the cases here reported: A saturated aqueous solution of methyl violet (5 B.) is drawn up in the tube of a 1 to 100 *melangeur* until it has filled four of the decimal divisions on the tube, and then it is followed with the fresh cerebrospinal fluid until the bulb of the instrument is full. This furnishes a mixture, slightly darker than ordinary "Toison solution," containing 996 parts in 1000 of the fluid for examination. In this way the leukocytes are stained violet, the erythrocytes preserve their hue, and with the usual blood-counting chamber the cells can be rapidly enumerated. With this no immediate differential count is possible; indeed, there are few specimens that yield in the counting chamber material sufficient for differential enumeration. For this purpose another part of the fluid is well centrifugalized, decanted, and the sediment left clinging at the base of the tube taken up in a capillary pipette, spread, dried, and stained.

Joffroy and Mercier put the normal number of cells as 0 to 2 per c.mm. They consider over 5 per c.mm. as strictly indicative

[8] Compt.-rend. Soc. de biol., Paris, 1901, liii, 529.
[9] Jour. Ment. Path., New York, 1902, iii, 57.
[10] Wien. med. Presse, 1904.
[11] Amer. Jour. Insan., Utica, N. Y., lx, 107.
[12] Jour. Mich. Med. Soc., 1906, v, 367.

of a pathological process in the meninges; they deem doubtful a count between 2 and 5 per c.mm., and advise another puncture.

The proteins of the cerebrospinal fluid are two, serum albumin and serum globulin, a trace only of the latter being present. An increase in the protein amount during purulent meningitis, and sometimes after intracranial hemorrhage, was early noted; but it remained for Guillain and Parant, in 1903, to point out a protein increase and the individual constituents thereof, in certain chronic nervous diseases, notably paresis. They treated the fluid in the cold with a saturated solution of magnesium sulphate, boiled the filtrate, and found a considerable quantity of albumin present. They thought albumin always pathological, but Sabrazes[13] demonstrated a trace of it in the normal fluid. Nageotte advised the routine calculation of the total protein by means of Esbach's solution and a 1 to 10 dilution of the fluid. Nissl[14] uses Esbach's solution, a centrifuge tube of special shape and graduation, and he reads off the precipitate in terms of an arbitrary scale, not of one reduced to terms of grams per liter. With this apparatus Rehm has found that the average amount of protein in the cerebrospinal fluid of paretics is much above the normal, but that there are individual instances in which the upper limit of the normal is not exceeded.

So far, careful analyses have shown that the gross quantity of protein alone is important for clinical purposes. A method such as that of Esbach for the urine seems sufficient for the estimation, but Nissl's modification of this method requires a special instrument; and Nageotte's 1 to 10 dilution of the fluid gives scale readings ($\frac{1}{10}$ gram for each gram actually present) which suppose more accuracy than the Esbach tube affords. Accordingly, in my own work, a simple means was sought by which the undiluted specimen could be used. The Esbach tube commonly sold for urine work requires more fluid than is safely obtainable at lumbar puncture, and, therefore, a test-tube of approximately 9 mm. bore was adopted. From it readings were taken as from the Esbach, and it became clear on experiment that such readings correspond with those obtained in the wider tube. Fortunately the precipitate from specimens that are normal is slight. In the markedly pathological the narrow tube sometimes chokes with flocculi. Fluids supernatant after centrifugalization of the cells may be employed for the test: 5 to 6 c.c. is required. In the cases here given the specimen was not acidified before addition of the picric-acid solution, though the reaction was, when tested, faintly alkaline to litmus, as is the rule with cerebrospinal fluid obtained during life. It may be objected that the method is arbitrary until proved otherwise, that it is coarse, and that it is open to well-known errors, dependent on temperature

[13] Gaz. hebdom. des Sci. méd. de Bordeaux, 1903, 376 (reviewed in Rev. neurol., Paris, 1903 xi, 1062).

[14] Centralbl. f. Nervenh. u. Psychiat., Coblenz and Leipzig, 1904, xv, 225.

changes, and on the presence of much protein; but it suffices for the purpose in hand. It was used for the cases that follow.[15]

The pressure in the subarachnoid space in health equals that in the ventricles of the brain; and the pressure found on lumbar puncture thus indicates that of the fluid in the whole central nervous cavity, unless there exists an obstruction of some sort. Krönig defined the normal pressure, with the patient in the lateral decubitus, as between 120 and 180 mm. of distilled water. The difficulties of exact measurements are obvious, so that most investigators are satisfied with stating that the pressure, as determined at lumbar puncture, is high or low, according as the fluid spurts or drips slowly from the hollow needle. Any tissue shred which prevents quick escape of the fluid has a power to nullify entirely an observation of this sort: and not infrequently it has been found that, though the fluid flows slowly, the pressure is high. For measurements to be precise none of the fluid should leave the subarachnoid space, since with its outflow tension is at once lowered. But for clinical measurements it is indifferent that 1 to 2 c.c. of the total 120 to 150 c.c. (Mott) should escape. One may, then, join a vertical tube directly to the puncture needle, and thus estimate pressure in terms of the fluid itself. This method for several years has been in use at the Johns Hopkins Hospital. The tube employed is thick-walled, of approximately 1.5 mm. diameter, and it has a capillary error of 20 mm. of normal cerebrospinal fluid. To measure a pressure of 500 mm. in such manner requires only 0.9 c.c. of the fluid. Pulse and respiratory waves in the column show its direct pressure connection with the subarachnoid space. When these are lacking a technical error may be looked for.

With the means described, fluids from the following cases have been examined:

Group I. Cases of disease other than nervous.

Group II. Cases of nervous disease, showing no abnormality of the fluid.

Group III. Cases of tuberculous meningitis.

Group IV. Cases of "purulent meningitis" due to infection with the streptococcus, Diplococcus pneumoniæ, or Micrococcus meningitidis.

Group V. Cases without "purulent" or tuberculous meningitis, but with abnormality of the cerebrospinal fluid.

Properly speaking, only fluids from Group I may be considered as normal—merely normal, in the sense that they were not associated with a meningeal lesion, for the patients were often very ill and not infrequently delirious. In Group II the fluids bore the

[15] Doubtless a solution of phosphotungstic acid in hydrochloric acid, such as that devised by Boggs for the estimation of the protein in milk (Johns Hopkins Hosp. Bull., 1906, xvii, 342), would, by reason of the even precipitation it causes, prove better than Esbach's solution in dealing with the cerebrospinal fluid.

characteristics made familiar by those in Group I, that is to say, the findings seemed void of any evidence for a meningeal lesion. One may, then, in a discussion of what constitutes the clinically normal fluid, take Groups I and II together. It must be admitted that in the instances in which there was no autopsy the absence from the meninges of a pathological process cannot be absolutely affirmed. In these instances, however, the course of the disease subsequent to lumbar puncture did not suggest such process. Whether the meninges can be injured without evidence of it in the fluid at one time or another is a point only recently suggested and as yet unsettled.

Group I. Cases of Disease other than Nervous.

Nine specimens of fluid were examined from 7 patients, of whom 2 had acute lobar pneumonia, 1 general tuberculosis, 1 tuberculous peritonitis, 1 arthritis deformans, 1 amœbic dysentery, and 1 a pelvic abscess. In the 3 cases that came to autopsy the meninges were normal.

Group II. Cases of Nervous Disease, Showing no Abnormality of the Cerebrospinal Fluid.

From the 7 cases included here 11 specimens of fluid were obtained. These came from an arteriosclerotic with mental symptoms, from 2 patients with tabes dorsalis (the disease of ten and thirty years' duration respectively), from 1 case of brain tumor, 1 of Korsakoff's psychosis, 1 of internal hydrocephalus, and 1 of Little's disease. Two autopsies were obtained, at each of which the meninges were found to be normal.

The number of cells in the 20 instances varied from 0.5 to 6.5 per c.mm., with an average of 2.75. In no specimen figuring here, or in the groups that follow, were cells entirely absent, though they were often few; and it seems doubtful whether they are ever quite lacking, as many think. The fact that the fluid on standing even four hours suffers a diminution in cells, and in the course of forty-eight hours often loses them completely, may explain such opinion. The upper limit of the normal, as given by Joffroy and Mercier, Fuchs and Rosenthal, may also be called in question. The case of pelvic abscess in Group I showed (at first puncture) 6.5 cells per c.mm., without at autopsy any perceptible meningeal change.

On a puncture in one of the instances of acute lobar pneumonia the fluid was contaminated with blood. In such instances the value of a counting medium which preserves the red cells becomes apparent. Bard, studying the tonicity of the cerebrospinal fluid as indicated by its behavior to the red cells, has shown them to be preserved in the normal and in some pathological fluids. Should

the fluid be hypotonic and the blood laked, as may happen on centrifugalization, instead of a colorless fluid above the sedimented corpuscles, one tinted with hemoglobin is found. In the case cited 28 white cells per c.mm. were present with many red cells. The latter could also be counted, since the fluid was hypertonic: they were 20,000 per c.mm. From the ratio between the erythrocytes (4,700,000) and the leukocytes (6800 per c.mm.) in the patient's circulation on the day of puncture, it could be said that the increased number of white cells in the cerebrospinal fluid was due wholly to blood contamination. A similar process was required for one specimen of the five taken from the case of Little's disease in Group II, and here also the fluid was found normal as regards cells. Such conclusion is safe. It is a very different matter to call pathological a fluid obscured by fresh blood, on the ground that many more white cells are present than the blood seems to account for. Here one must be quite sure that no laking has occurred. Laking may be detected from the tint of the fluid supernatant after centrifugalization or from the aspect of the red cells in the counting-chamber, which appear as "shadows." Further on will be considered a specimen which, though contaminated with blood, could be determined to be pathological. Thus a fluid rendered bloody at the time of puncture may always, in case no laking has taken place, be used for a cell count. A differential count of the cells intrinsic to the fluid is, of course, impossible under the circumstances.

From Groups I and II eight differential counts were made with Hastings' stain. Mononuclears of all sizes up to those which may be classed as "large" were seen, but no polymorphonuclears were observed except in association with blood.

The protein content varied but little, considering the method employed; the lowest amount was $\frac{1}{6}$ gram per liter, the highest $\frac{3}{8}$ gram, the average $\frac{1}{3}$ gram. These figures agree roughly with those from careful analyses. Even at this date there is a wide variation in the latter. Halliburton (in a patient with escape of cerebrospinal fluid through the nose) found 1 gram per liter, and Nissl quotes the findings of various observers as follows: Quincke, 0.2 to 0.5 gram per liter; Riecken, 0.5 to 1 gram per liter; Gumprecht, 0.25 gram per liter. For clinical purposes, the method gives, in a most general sense, a quantitative determination of the normal amount of protein. With it this averages $\frac{1}{3}$ gram and is always below $\frac{1}{2}$ gram per liter.

Pressures varied between 70 and 300 mm., with the high average of 210 mm., a considerable variation from Krönig's "normal range" between 120 and 180 mm. But it is to be remembered that any factor altering the blood pressure, such as coughing, straining, or fright, affects the pressure in the subarachnoid space. Position of the body affects it too: hence all pressures were taken, as is desirable, with the patient lying on his side, the knees drawn up, and the

head on a level with the vertebral column. The one point to be emphasized is that the pressure varies much more than observations on a sound person, under special conditions, would lead one to suppose. It is unwise to infer anything awry in the central nervous system from pressure changes, except when they are most marked.

Group III. Cases of Tuberculous Meningitis.

There were 9 of these and in all 17 punctures were made on them. Two of the cases lacked verification by autopsy or by the discovery of acid-fast bacilli in the fluid, but clinically they were characteristic.

In 5 of the patients the fluid gave evidence of the existence of a pathological process—by color, by haziness, or by the formation of a reticulum on standing; but in 4 there was nothing macroscopically to denote it, in spite of the presence of as many leukocytes (in one instance) as 300 per c.mm. Froin and Ramond[16] have found in a clear cerebrospinal fluid as many as 500 white cells per c.mm.

In all of the 17 specimens of fluid the cells were much increased. Never below 43 per c.mm., the count ran as high as 686 with an average of 213; and in all cases and at all punctures but one there were over 100 per c.mm. Fuchs and Rosenthal, Froin and Ramond give the only other series of quantitative determinations for tuberculous meningitis. In the 7 cases examined by the former investigators the cells numbered from 80 to 952 per c.mm. Froin and Ramond found a greater variation in their 24 specimens from 9 patients; there were "according to the cases, from 5, 16, 20, to 80 white cells per c.mm. to 800, 1000, and 1200." These authors unfortunately do not state whether the low counts were obtained early in the course of the disease, and whether the pathological findings giving rise to them were unusual. In any event it is clear that from among 48 specimens of cerebrospinal fluid yielded by patients with tuberculous meningitis only 4 contained less than 80 white cells per c.mm. and only 1 of these gave—under circumstances of which we do not know—a normal count.

In this connection may be cited the few counts on record for other diseases, the results combined of Joffroy and Mercier, Rosenthal and Fuchs, Kramer, and Simpson:

Paresis: 80 cases—5 to 204 cells per c.mm. (lymphocytes: in only 6 cases were over 100 cells per c.mm. obtained); 9 cases—0 to 5 cells.

Dementia Præcox: 25 cases—0 to 2 cells.

Tabes: 4 cases—17 to 88 cells; 4 cases—0 to 5 cells.

Alcoholism: 17 cases—0 to 2 cells.

Miscellaneous Psychoses (not on a syphilitic basis): 24 cases—0 to 2 cells.

[16] Compt.-rend. Soc. de biol., Paris, 1905, lix, 417.

In summary, the fluid in paresis has in nearly 90 per cent. of the cases an increase in cells, while in dementia præcox, in alcoholism, and in psychoses which do not depend on syphilis the count is normal.

A comparison of the figures for tabes and paresis with those for tuberculous meningitis makes it plain that in this last disease the "spinal leukocytosis" is most constant and most pronounced. The mass of cases show more than 100 cells per c.mm., whereas it is the rule in paresis that the cells, while increased, range well below 100 per c.mm. The 3 cases of cerebrospinal syphilis in Group V agree with this rule.

That the precise count has little value when the cell increase is large was brought out by collecting the fluid at one puncture in three tubes, and estimating the cells from the first and last of these. A difference, often great, between the two was demonstrable: Tube I, 325 leukocytes per c.mm., Tube III, 200 leukocytes; Tube I, 266 leukocytes, Tube III, 686 leukocytes. Cases in Groups IV and V also showed this. Sometimes the first tube had more cells per c.mm., sometimes the last, but it is interesting that, whichever the arrangement, it held good through later punctures on the same patient. Doubtless such a relation has some bearing on the site of the lesion, and the thought at once suggests itself that if the patient be in the sitting posture when tapped the comparison of the first with the last fluid in special cases might give some clue as to whether the lesion is generalized or is more marked high or low in the spinal column. But in any attempt to secure enough fluid to yield a contrast between the first fluid and the last drawn off the danger of the procedure must always be borne in mind; the subarachnoid space must not be more depleted than is safe.

The differential counts brought out little beyond the general tendency to lymphocytosis. Cell percentages were the same in the first fluid and in the last obtained at the same puncture. No change in the count common to all cases as they progressed was noted. Indeed, the fallacy of other than the most general cell formulæ has now been recognized by Widal and Sicard, who were themselves responsible for the doctrine of specific formulæ. To quote them: "The presence of polymorphonuclears in the course of tuberculous meningitis coincides neither with the state of the malady, the age of the patient, the anatomical type of the meningitis, nor with the presence of secondary infective agents. There is too much discord in the cases observed for one to establish a rule."

Throughout the series the protein content was increased. It ranged from 0.5 gram per liter to, in one instance, over 10 grams. This last case was exceptional in many ways and the autopsy showed an extraordinary gelatinous meningitis. In the other 8 cases, which clinically or pathologically approached the type, the protein did not measure more than 1.75 gram per liter and averaged slightly less than 1 gram.

Pressure at the initial puncture varied between 240 and 550 mm. of the fluid itself, with 365 mm. as an average. Later punctures usually showed a lower pressure, once 50 mm., so that the extremes of pressure were 50 and 550 mm. The mean, greatly above that for the normal, was 308 mm. for the 13 instances in which pressure was measured.

Most importance attaches to a view of the class as a whole. Protein, pressure, and cell-content were increased largely, even in specimens quite limpid. The results as regards cell-content were more marked than those in other processes—paresis, tabes, syphilis—yielding lymphocytosis in a clear fluid. While a diagnosis of tuberculous meningitis *intra vitam* cannot be absolute without discovery of the characteristic bacilli or a positive result on animal inoculation, yet a clear or slightly turbid cerebrospinal fluid under increased tension, with over 100 cells per c.mm., among which lymphocytes predominate, and an increase in protein on Esbach's test, strongly point to the lesion. A long-standing purulent meningitis in which the many polymorphonuclear cells have been replaced by a few mononuclears, and an occasional case of paresis, are the only other conditions likely to yield such a fluid.

The power to confirm, by these means, a diagnosis of tuberculous meningitis is not so important as is that to rule it out absolutely. As has been shown, there were, in all the specimens that came under my observation, readily appreciable changes in the fluid as regards pressure, protein, and cell number. In several other patients tuberculous meningitis was suspected at the time of puncture, but results from the fluid seemed against this and the subsequent course of the cases proved other maladies to have been present. Mere failure to find tubercle bacilli in the cerebrospinal fluid does not enable one to dismiss with certainty the possibility of tuberculous meningitis, nor does the finding that cells in the fluid are few by the method of centrifugalization and an estimation of cell number per oil-immersion field. But it would seem that one can affirm the absence of the disease when the fluid conforms to the normal as regards pressure, protein, and cell-content, as here determined. Whether there are exceptions to this remains to be observed.

Group IV. Cases of "Purulent Meningitis" due to Streptococcus pyogenes, Diplococcus pneumoniæ, or Micrococcus meningitidis.

Twelve punctures were made on 6 cases—1 of streptococcic meningitis secondary to otitis media, another developing in the course of an ulcerative endocarditis due to the streptococcus, 1 of pneumococcic meningitis following operation, and 3 due to Micrococcus meningitidis. It may be urged that determinations of the sort dealt with here are scarcely necessary, since immediately on

puncture the condition of the fluid is obvious. Indeed, from several specimens a coagulum separated so rapidly as to prevent the cell count. Some cases in which this occurred are not included in the group.

During the acute process, so far as the cases I have studied may indicate, pressure, protein, and cell-content of the fluid are all high—protein and cell-content higher usually than in tuberculous meningitis. Among the cells present polymorphonuclear neutrophiles predominate. A typical finding is that in the case of J., obtained at the second day of a streptococcic meningitis following otitis media: pressure 380 mm. of the fluid itself, protein 4 grams per liter, leukocytes 4700 per c.mm., 96 per cent. of them neutrophiles. Pressure in the acute cases ranged between 290 and 560 mm., averaging 390 mm.; protein ranged from 1 gram to 5 grams and averaged 2.5 grams; and the cells varied from 1300 per c.mm., 20,000, 30,000, to such numbers as made up a thick pus.

With chronicity came mononuclears and a fluid that could not be distinguished by protein, pressure, cell number and character from that of tuberculous meningitis. To cite an instance: A specimen from B., in the sixth week of cerebrospinal fever, registered a pressure of 230 mm., protein 1 gram per liter, cells 580 per c.mm., of which 67 per cent. were lymphocytes, 1.5 per cent. large mononuclears, 31.5 per cent. neutrophiles. It is also questionable whether a distinction from tuberculous meningitis can be made when a process, later to become purulent, is slowly gaining headway, or when a purulent lesion is focal in character. A patient with ulcerative endocarditis was delirious when first punctured, but presented no other symptoms suggesting a lesion of the central nervous system. At this time pressure and protein were normal, but a cell count of 15 lymphocytes per c.mm. was thought to indicate a slight meningeal reaction. Four days later, just before death, he developed stiffness of the neck, but without Kernig's sign or other suggestive feature. Puncture yielded, under a pressure of 290 mm., a purulent fluid, sterile to culture, which had 5 grams of protein per liter, and 8400 white cells per c.mm., of which 98 per cent. were neutrophiles; and autopsy showed an ulcerative endocarditis (streptococcic), infarct of the spleen, and a purulent meningitis, localized almost completely at the base of the brain. In this case one could infer no further from the first puncture than that slight meningeal irritation seemed present.

The first few cubic centimeters and the last, obtained at one puncture, frequently differed much in cell number, just as in tuberculous meningitis. Sometimes this was noted macroscopically when no count could be made.

Group V. Cases without "Purulent" or Tuberculous Meningitis, but with Abnormalities in the Cerebrospinal Fluid.

These deserve an almost individual consideration.

There were 3 instances of brain tumor and 4 punctures made on them. At these the pressure was found to be, as is usual, high—380, 490, and 580 mm. (and once not measured exactly) on estimation as previously described—but in only 1 case was the fluid itself pathological in the sense considered here. In this patient, a man with cerebral tumor, for which later a decompressive operation was performed, it was amber yellow, with 1 gram protein per liter, and 5.5 white cells per c.mm., 83 per cent. of them lymphocytes, 9 per cent. large mononuclears, and 8 per cent. polymorphonuclear neutrophiles. In Group II was cited an instance of brain tumor in which protein, pressure, and cell-content were entirely normal. Babinski and Nageotte found an absence of white cells from the cerebrospinal fluid in 7 cases of cerebral tumor, and Widal in 9; Laubry, using the same technique, which was to ascertain cell number per oil-immersion field in the sediment obtained by centrifugalization, observed a slight lymphocytosis in the fluid obtained from a patient with endothelioma of the cerebellum. These results do not permit generalization with regard to the findings in the cerebrospinal fluid of brain tumor, further than a remark on the frequent incidence of increased pressure in the subarachnoid space, as already noted at lumbar puncture by many observers.

One case of uremia exhibited high pressure (350 mm.) without cell or protein increase. Another, B., had uremic convulsions with hemorrhage into the brain six days previous to the first tapping. This gave a fluid contaminated with fresh blood: pressure 590 mm., protein $\frac{1}{3}$ gram per liter, cells—Tube I, erythrocytes 14,300 per c.mm., leukocytes 99; Tube III, erythrocytes 24,280, leukocytes 275. At a second tapping twenty-four hours later, pressure was 420 mm. of the fluid itself, protein as before, and cells—Tube I, erythrocytes 29,200, leukocytes 578; Tube III, erythrocytes 21,600, leukocytes 817. At both the fluid was hypertonic; correction for the leukocytes introduced with the blood could be made on the ratio of the two in the blood as previously explained; and it became evident that many more leukocytes were present than a contamination could account for. So the fluids were deemed pathological as regards cells. A puncture thirteen days later helped confirm the observation; for the fluid now limpid and at a pressure of 300 mm. had 12 white cells per c.mm., lymphocytes this time, whereas before polymorphonuclear neutrophiles had predominated.

H., a baby aged two months, had convulsions in association with otitis media. A puncture at the height of the illness showed 47 white cells per c.mm., all neutrophiles. Cultures were negative.

The cerebrospinal fluid of the healthy baby has not been found to differ as regards cells from that of the adult; it may reasonably be inferred, therefore, that this patient had a slight meningitis.

Two specimens were examined from a case of syphilitic insanity, 1 from an instance of syphilitic hemiplegia, and 1 from a patient with chronic spinal meningitis, enduring twelve years, who denied venereal disease, but gave a history of sores, without varices, on both legs five years previous to his admission to the hospital. All showed cells in considerable numbers (45, 64, 45, 36 per c.mm.—lymphocytes exclusively) and two increased protein (a specimen from the first case $\frac{5}{8}$ gram per liter, that from the last $\frac{3}{4}$ gram). It is to be noted how far short falls the number of cells, 48 per c.mm. on the average, of the number found in tuberculous meningitis. The pressure, too, was only slightly or not at all increased in these cases (240, 50, 190 mm.). Sicard and Monod, and many workers after them, have noted a lymphocytosis in the fluid in cerebrospinal syphilis, but there are unfortunately no figures to indicate its degree. It seems, though, from these few observations to approximate that met with in paresis. The idea has been put forward that in paresis, tabes, and cerebrospinal syphilis the degree of lymphocytosis in the cerebrospinal fluid has relation to the acuteness of the process. The 2 cases of tabes entered perforce in Group II, because the fluid from them was not abnormal, had lasted ten and thirty years respectively, and the disease had ceased to progress.

Two hydrocephalic children showed high pressure (Case W., 560 mm.; Case G., 320, 500, and 150 mm. at the three punctures), with cells and protein at normal. One served to demonstrate a fact of much import. This patient, G., had some fluid withdrawn on three occasions at forty-eight-hour intervals. At first puncture the cells were 2 per c.mm.; at the second 183 per c.mm., mostly neutrophiles; at the third 18 per c.mm., largely lymphocytes.

Apparently the initial puncture gave rise to a meningeal irritation of some sort (whether bacterial is not known, as no cultures were taken) and this underwent rapid subsidence. The child's condition did not vary with these changes. On the second puncture a trace of fresh blood was found in the fluid, which itself remained yellow after centrifugalization. The red cells seen were well preserved, but from the tint of the fluid one might suppose partial laking to have occurred and attribute the whole increase in white cells to contamination, were it not for the preponderance of mononuclears at third puncture (in the clear fluid from which a few red cells were also obtained). The entire change in cell formula thus shown could hardly have taken place in the circulating blood during forty-eight hours, and this with no variation in the child's condition. On the other hand, such a change of the leukocytes present in the subarachnoid space is common. Assuming that this occurred, it is not improbable that an oozing of blood from the first puncture wound

into the cerebrospinal fluid, there breaking down, accounts both for the yellow color of the specimen obtained later and for its considerable content of white cells. However this may be, the theme is supported that, when the count from a second puncture coming soon after a first demonstrates a moderate increase in cells over the normal to be present, there is a possibility that this cell increase depends solely on injury done at the first puncture. The book rule to wait ten days before a second puncture seems justified.

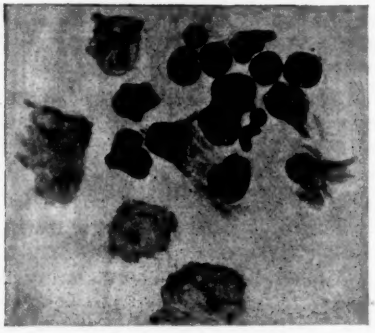
Under such reasoning the result in a case of toxic dementia, which falls in Group V because of a cell increase (cells 16 per c.mm.) is vitiated, and so too with the findings at second puncture of the patient with pelvic abscess in Group I (cells 11.5 per c.mm.). In each of these cases the subarachnoid space had been tapped shortly before.

Three cases remain undiscussed: In one, a toxic psychosis, the protein content was increased ($\frac{5}{8}$ gram); in the second, of general peritonitis, the pressure was equal to 400 mm. of the fluid; and in the third, the cerebrospinal fluid was abnormal, but the disease was, and remained, undiagnosticated. It may be thought that the findings in the first 2 cases should be placed with those obtained in Groups I and II, as the one case recovered without signs of meningitis, and the other had at autopsy no recognizable central nervous lesion. But, as the first was delirious and the second in coma at the time of puncture, it is safer to take them as unexplained variations rather than to allow them to modify one's conception of the normal fluid. Statistics must determine whether the range for the normal includes them.

In the differential counting for Group V, as well as in that for the other groups, there were frequently noted bodies, apparently organic, which could not be classified as cells and were not included in the counts made. Reticulated, basophilic, varying much in outline, they were the so-called "degenerated cells," "clear elements," "cellular transformations" which are sometimes mentioned. Villaret and Texier,[17] who alone seem to have given thought to the origin of these, separate three sorts derived respectively, they think, from the small mononuclears, from the large mononuclears and the polymorphonuclears, and from the endothelial cells. Though they have not supported their opinion experimentally it should be borne in mind, for the presence of these elements, if degeneration products, in large numbers, with but few normal cells, might indicate the waning of some previous meningeal inflammation. The autolytic digestion of leukocytes is now well understood; and there seems nothing against self-digestion of those in the cerebrospinal fluid (which itself contains no enzymes), provided they be not too speedily hurried into the lymph stream.

[17] Jour. de physiol. et de path. gén., Paris, 1905, vii, 841.

An attempt was made, in my work, to show whether the elements under discussion are degenerated cells. For this purpose specimens, obtained aseptically, of fluid known to contain many cells were incubated for varying periods and centrifugalized; slides from the sediment were spread and mounted in the usual manner. Control slides were always made from another portion of the same specimen while fresh, and cultures were taken after the incubation to demonstrate that bacteria had no part in the work. Several clear fluids from instances of tuberculous meningitis and one of normal cell-content were used. The result was in every instance the same: the cells were rapidly transformed into those doubtful bodies which had been observed on routine count. After four hours of incubation most of the lymphocytes (as lymphocytic fluids alone were used)



Cellular content of the cerebrospinal fluid from a case of tuberculous meningitis, showing several mononuclear cells, a polynuclear leukocyte, and a number of degenerated cells. × 660. (Camera lucida drawing; Hastings' stain.)

had lost, as shown with Hastings' stain, the distinction between nucleus and cytoplasm, were larger, slightly irregular in outline, and a deep bluish-purple with light splotches here and there. After eighteen hours all the cells were replaced by elements, the better preserved of them 15 to 25 μ in diameter, reticulated, basophilic, sharply defined at the edges, without trace of a nucleus. From these all gradations could be followed until only a ragged neutrophilic film, fading at the edges, was left about a poorly staining, refractile mass, suggesting nuclear material.[18] At the end of ninety-six hours these still persisted. Incubation was not carried farther. Hastings' mixture and Löffler's methylene blue were the stains used, and the sediment from the centrifugalized fluid was spread, dried at room temperature, and stained, without intermediate pro-

[18] Rubinato (Folia Hæmatologica, ii, 781), in a study of the forms occurring in the destruction of leukocytes, has very well described these appearances. He found them as the products of the degeneration of mononuclear cells only.

cedure. Violent centrifugalization and a strong stain brought out distortions of the degenerated cells, which under gentler methods could be avoided. But that such methods were not the cause of the forms described was shown by the controls.

A possible value for the fact that these "clear elements" are degenerated cells rests, as has been said, upon their significance when they make up the bulk of forms in a specimen. Can one suppose a long-standing "spinal lymphocytosis," or one previously acute, now retrograding? Unfortunately the hypothesis was too recently formulated for many instances bearing on it to be available for this paper. Certainly in the normal fluid they are always present, and in considerable number as compared with the sound cells. This is to be expected, since the persistence of one of these derivatives is longer, probably, than that of the leukocyte itself. Furthermore, in acute processes the number of them is few as compared with that in long-standing disease. They are rarely seen in smears from a purulent fluid, though in such the polymorphonuclear neutrophiles are often vacuolated and show pyknotic nuclei after the meningitis has progressed for a time.

Three cases especially showed these "clear elements": One in Group V, of "chronic spinal meningitis" with long-standing nerve-root pains, in which, at operation, a patch of thickened meninges was found, furnished them to the exclusion of the usual cells; one in Group III, with tuberculous meningitis of three months' duration, had them in large quantity; while at first puncture in a third case, that of L., described in Group IV, although the meningitis was just beginning, they were exceedingly numerous. One can, of course, offer, in this last instance, the explanation that a chronic process might previously have existed. Further work must show whether a clinical inference can be drawn from the presence in the cerebrospinal fluid of numerous degenerated cells.

My studies lead to the following conclusions:

1. The methods described herewith offer the means for a much more careful clinical study of the non-purulent, cerebrospinal fluid than has heretofore been usual. Determinations should always be made of the pressure in the subarachnoid cavity, of the protein content of the fluid, the number of cells per c.mm., and their kind.

2. By these means a specimen may often be pronounced pathological which under the ordinary examination appears normal. Admixture of blood does not necessarily render a fluid valueless.

3. Normal fluids differ but little in quantitative cell-content. It is doubtful whether cells are ever wholly lacking, and up to 7 per c.mm. may provisionally be set as the range in specimens not pathological. The normal protein-content, too, lies within well-defined limits. On the other hand, pressure variations which depend on factors other than a lesion of the central nervous system are wide.

4. Except along the broadest lines there is nothing specific in the

permutations of protein, pressure, and cells. But along these lines the fluid from cases of tuberculous meningitis is characteristic, as compared with that from cases of paresis or of cerebrospinal syphilis, and these also differ from the normal fluid. If a case be suspected to be one of tuberculous meningitis, but the fluid prove to be normal as regards pressure, protein, and cells, the disease may be ruled out. This rule probably holds absolutely, but it is desirable that more cases be studied before the statement is too strongly made.

5. The "clear elements," "cellular degenerations," "pseudo-endothelial cells," often noted, are definitely proved to be degenerated cells.

Most of the cases studied were from Dr. Barker's wards. My thanks are further due to him for the suggestion of this work, to Dr. Cushing for fluid from patients with hydrocephalus, and to Dr. R. I. Cole for much helpful advice during the work.

TROPICAL NEURASTHENIA AND ITS RELATION TO TROPICAL ACCLIMATION.

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of Madison, Wis.,

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It is strange that the nerve exhaustion of the tropics, which is so very prevalent among those who have sojourned for any considerable time in our island possessions, is scarcely mentioned by writers on tropical subjects. This form of nerve exhaustion, not so much on account of difference of symptoms from the usual manifestations of neurasthenia, but on account of its etiology, should receive the designation of tropical neurasthenia. The literature on the subject is very meagre. I cannot find mention of the disease by German, French, or English writers, and it is scarcely recognized by American authors.

Woodruff[1] states: "I have never seen any account of the terrible nervous exhaustion which results from long-continued exposure to great heat and moisture. It is a veritable neurasthenia. There is no escape from the heat, day or night. One wakes up at night drenched with perspiration. It wears out nervous force quickly and surely. Now the symptoms of exhaustion are everywhere. I never heard so many complaints of persistent insomnia as I did in the Philippines. One young, vigorous staff officer, who seemed

[1] The Soldier in the Tropics. Phil. Med. Journ., April 7, 1900; Effects of Tropical Light on White Men.

always cool, complained to me one day that on the previous afternoon at five o'clock he found that he could not remember anything he read. When he got to the end of a sentence he had forgotten the beginning. He was completely disabled until the next morning. A surgeon informed me that before he was half through his rounds, he daily discovered that he could not remember the patients' answers, and he always had to lie down thirty to sixty minutes before the brain would again work properly. This general exhaustion, which is such a common occurrence as almost to merit the special term of tropical exhaustion, deserves the greatest attention. It reduces man's resistance to every disease, as his natural immunity is gone."

I may quote the following, from an article by myself:[2] "The majority of American women who have resided for some length of time in the Philippines suffer with what we call tropical neurasthenia. They become nervous, irritable, anemic, lose weight, suffer with neuralgia, spells of faintness, sleep poorly, and almost invariably are troubled with menorrhagia and dysmenorrhœa." In a later monograph Woodruff again refers to the neurasthenia of white men in the tropics. Indeed, the object of his monograph is to prove that these tropical exhaustions are caused by the actinic or short waves of light which are of greater intensity in the tropics. Outside the above I have been unable to find anything of importance in literature relating to tropical neurasthenia—a disease, I believe, that is not only very prevalent in the Philippines, but is also an important factor in preventing acclimation of white men in the tropics and will prevent the successful colonization of the Philippines by Americans.

If we search for the true cause of the invalidism of so many public servants in the Insular service we find that a large percentage of the 50 per cent. (as stated by Musgrave[3] as due to intestinal amœbiases) had been suffering for some time with tropical neurasthenia which had destroyed their natural immunity and made them very susceptible to amœbic infection. From experience in private practice and government service, I can say that nearly all American women and a large proportion of men who have been in the Islands one year or more suffer, at least to some extent, with nerve exhaustion. It is conservative to state that 50 per cent. of the women and 30 per cent. of the men suffer with neurasthenia to such an extent that they are in a state of semi-invalidism. These persons cannot easily concentrate their minds on their work, they suffer with loss of memory, they become easily fatigued, and they cannot do the efficient work they were formerly capable of doing. There is no doubt that directly and indirectly tropical neurasthenia incapacitates more white men in the Philippines than all other causes

[2] The American Physician in the Philippine Civil Service. Amer. Med., April 1, 1905.

[3] Treatment of Intestinal Amœbiasis in the Tropics, Bulletin No. 18, Bureau of Government Laboratories, Manila, 1904.

combined and seems to be the main hindrance to the ability of white people to become acclimated in the tropics.

SYMPTOMS. The symptoms of the nerve exhaustion of the tropics are not unlike neurasthenia, as seen in America. There are, however, a few minor differences which I shall consider.

1. In regard to women, menstrual derangements, metrorrhagia, menorrhagia, and dysmenorrhœa are much more prevalent in the Philippines as an accompaniment of neurasthenia than in this country. It is safe to say that ninety-five out of every hundred women who suffer with neurasthenia suffer with these menstrual troubles, and the majority of these to a very marked degree. These menstrual disorders are not unknown in this country. Brower has noticed them in about 20 per cent. of neurasthenic women who have come under his notice, but they were not marked. Richard Dewey has noticed a few severe cases in neurasthenics, but believes that neurasthenia did not cause, but only aggravated, the disorder. Whether these menstrual disorders are caused by relaxation due to excessive heat and a moist climate, or to some derangement in the vasomotor mechanism due to the neurasthenic condition, is still open to question. It is probable, however, that both influences work together to produce the condition.

2. Vasomotor symptoms seem to be somewhat more prominent in tropical neurasthenia. Among the most important of these are angioneurotic œdema, which Quincke regards as a vasomotor neurosis under the influence of which the permeability of vessels is suddenly increased. Pemphigus, which is generally known to accompany changes in trophic nerves, is also quite prevalent. Localized sweating, œdemas, etc., are quite common.

3. Tropical neurasthenia responds more readily to treatment than ordinary neurasthenia. Change of climate is especially effective. Many subjects leave Manila in a most exhausted condition, but after a short stay in Japan, or a voyage across the Pacific, their condition is remarkably improved.

ETIOLOGY. As regards the etiology of tropical neurasthenia—it differs from that of the neurasthenia of this country. Overwork, worry, heredity, abuse of alcohol, certain infectious diseases, etc., predispose to tropical neurasthenia, as in America, but they do not seem to be the main causes. The etiology of tropical neurasthenia may be discussed under the following heads: (1) Manner of living; (2) the effect of certain infectious diseases, such as dengue fever, dysentery, etc.; (3) the effect of the excessive use of alcohol; (4) the effect of the rays of the sun; and (5) the effect of continuous and excessive moist heat.

1. Many Americans, on reaching the Philippines, attempt to continue the same active life that they are accustomed to in the United States. They attempt to work the same number of hours, they go out in the sun without protection, and they take no midday

siesta. When going to a new country, it is always a good plan to study the prevailing customs and not try to follow one's old mode of living under different conditions. The native Philippino works fewer hours than we do. He is careful to protect himself from the hot sun, and he invariably sleeps from 12 to 3 in the afternoon. If Americans persist in disregarding the customs of the country, and try to continue their accustomed activity, they may expect an early nervous breakdown.

2. Certain infectious diseases prevalent in the Philippines predispose to nerve exhaustion. The most important of these are dengue fever and amœbic dysentery. During certain seasons of the year dengue fever is epidemic and attacks a large proportion of the population. The ensuing prostration is often extreme and usually continues long after the disappearance of the fever. In many people an attack of dengue fever is the beginning of their neurasthenic condition. Amœbic dysentery, if long continued, is very exhausting and predisposes to or increases the neurasthenia.

3. There is great difference of opinion in regard to the effect of alcohol in the tropics. Woodruff states that "statistics of about 2800 soldiers show that the damage done to these vigorous men by the small amount of excessive drinking they indulged in was not so great as the damage done by the climate to the total abstainers. Approximately, 11 per cent. of the abstainers died, while about 3.5 per cent of the moderate drinkers, and less than 2 per cent. of the excessive drinkers died. About 15 per cent. of abstainers were invalided home, about 9 per cent. of the moderate drinkers, and about 8 per cent. of the excessive drinkers." Other observers give a directly opposite opinion—that nowhere are the effects of alcohol so detrimental as in the tropics. Some writers state that the excessive use of alcohol is one of the main factors serving to prevent the colonization of the tropics by white men. I have not been able to make systematic observations of this subject and must leave the question open to farther investigation. It is possible, however, that the moderate use of alcohol may serve to prevent intestinal infection by certain parasites, (1) by stimulating the action of the gastric juice, and (2) by its antiseptic action on the parasites themselves.

4. The actinic theory of the cause of neurasthenia in the tropics, promulgated by Major Woodruff,[4] demands special attention. This work originated as stated in the preface "in an attempt to prove or disprove the theory announced by von Schmädel, in a paper read before the Anthropological Society of Munich, in 1895, that skin pigmentation of man was evolved for the purpose of excluding the dangerous actinic or short rays of light which destroy living protoplasm." The argument runs as follows:

[4] Effects of Tropical Light on White Men.

The actinic rays of the spectrum, also called ultra-violet or photographic rays, which are invisible rays of very short wave length, are known to cause great damage to living protoplasm. Man also suffers from the effect of these rays if he is so situated that the rays are strong enough to penetrate the skin and exert their chemical effects on the tissues. It is the pigment in the skin which ordinarily protects man from the dangerous effects of these rays. The amount of pigment in each individual is in direct proportion to the intensity of the light of the country to which his ancestors have proved their adjustment by centuries of survival in health and vigor. If, therefore, man remains in the environment to which he has become accustomed for thousands of years, his pigmentation is sufficient to prevent the penetration of the ultra-violet or actinic rays. As we go south, the light becomes more intense, first, because the amount of light per unit of surface increases, and, second, as we go nearer the equator the layer of air which the rays must pass through is thinner and fewer rays are absorbed. The inhabitants of the tropics, therefore, in order to counteract these increased actinic rays have, after many centuries, developed more pigment in their skin than northern races. The white man in going to a tropical country like the Philippines leaves the environment where perhaps his ancestors have resided for centuries, and exposes himself to actinic rays which penetrate the skin (it being insufficiently pigmented) and exerts certain chemical action on the tissues which is responsible for the neurasthenia as seen in the tropics.

Woodruff has noticed that brunette types do better in the Philippines than blondes. He even contends that the entire United States, with the exception of parts of Washington and Oregon, is too far south for blondes. City life in the United States on account of the glare is especially prejudicial to the health of blondes. He cites the fact that the Norwegians and Swedes coming from 60° and above to 45° and under, arrive here as vigorous men and women, but in a generation or two they degenerate into weak and neurasthenic men and women, many of whom succumb to tuberculosis. To prove his theory, Woodruff goes into the question very fully; actinic therapy is reviewed up to date. Many examples are given illustrating the effects of excessive light and the result of the migrations of blonde races is gone into from the earliest time until now. Just how the actinic rays on penetrating the skin bring about the state of nerve exhaustion is perhaps left a little indefinite, but overstimulation seems to be the view put forth.

Dr. James Weir, Jr., is quoted as follows: "Their action (the violet rays) must be, I take it, primarily through stimulation of the vasomotor nerves. The first effect is dynamic in character, there is a dilatation of the bloodvessels with a consequent flow of blood. The second effect is chemical in nature; the increased flow of blood incites the blood-producing organs to manufacture new blood cells.

There is also increased oxidation and oxygenation through the lungs. The third effect is purely physiological. Owing to the increased flow of new blood cells to the tissues, cell growth is excited and new tissue is formed." A little stimulation like the above is considered beneficial, but as the short rays become more intense, stimulation of metabolism is increased to such an extent that the functions become exhausted and a neurasthenic condition develops.

This theory, as presented by Major Woodruff, is very convincing, and, although the effect of the violet and ultra-violet rays may not play such an all-important part as he suggested, there can be no doubt that they play an important part in the etiology of tropical nerve exhaustion.

5. As regards the action of continuous moist heat in the production of neurasthenia, we know that excessive bodily heat is regulated mainly by the skin. The more blood that passes through the skin the greater the loss of heat by conduction, radiation, and evaporation. To accommodate a great flow of blood through the skin the arterioles of the skin must dilate. This may be produced in two ways: (1) Blood of a higher temperature than natural flowing over the vasomotor centres will stimulate the vasodilator fibers and cause the arterioles to dilate, and (2) warmth acting on the exterior of the body by stimulating sensory nerves will cause the skin arterioles reflexly to dilate. Sweating usually accompanies the increased blood flow through the skin, as the sweat centres in the spinal cord are stimulated either directly or reflexly in the same manner as the vasomotor centres.

The climate in the Philippines is such that during a greater portion of the time conditions are present which excite an increased flow of blood through the skin. These conditions are present nine months out of twelve and eighteen hours out of the twenty-four, and are dependent on the fact that in the Philippines there is a high temperature and a relatively high humidity. The reports of the Manila Weather Bureau covering a period of over twenty years show that the highest mean monthly maximum temperature is 96.98° F. in May, the lowest mean monthly maximum 89.78° F. in Decemer, with an average of 92.48° F., as the average mean maximum for the year. During the same period the highest mean monthly minimum is 72.86° F., also in May, and the lowest mean monthly minimum 64.22° F. in January, with an average of 69.08° F. as the average mean minimum for the year.

The temperature in Manila not only averages higher throughout the year than in our hottest summer months, but the relative humidity is considerably higher, as seen by the following table, in which the average temperature of three American cities for the three hottest months of the year, June, July, and August, is compared with the average temperature of Manila for the whole year and with the

average temperature of the three coldest months in Manila, December, January, and February.

	Mean.	Mean max.	Mean min.	
Manila	80.42	92.48	69.08	Average temperature.
Manila	77.54	90.26	64.52	Three coldest months.
Chicago	68.1	74.9	61.8	Three hottest months.
Washington	73.1	84.2	63.3	Three hottest months.
New Orleans	82.1	91.4	75.4	Three hottest months.

The effect of the temperature is still more intensified by the fact that the relative humidity is very high in Manila.

The following table taken from the report of the chief of the Manila Weather Bureau conveys an idea of the relative humidity of certain cities in the United States as compared with Manila:

	Mean relative humidity.
Manila	79.4
Phœnix, Arizona	38.7
El Paso, Texas	38.8
Denver, Colorado	48.7
Pierre, S. D.	64.7
St. Louis	69.5
Philadelphia	70.3
St. Paul	71.9
Washington	72.3
New York	73.2
Milwaukee	74.9
Chicago	74.8
New Orleans	77.3
San Francisco	79.9
Block Island	81.2
Atlantic City	81.4

There are but few localities in the United States which surpass Manila in relative humidity. Even the locality of Milwaukee and Chicago, which is considered of high humidity, is surpassed by Manila nearly 5 per cent. The effects of such high temperature combined with the high percentage of humidity is well expressed by Prof. Dexter,[5] of the University of Illinois: "Excessive heat, together with great humidity, forms a most deadly combination for one not acclimated to it."

Stewart[6] states: "In a warm atmosphere the skin is flushed with blood, its vessels are dilated, its temperature is increased; an effort, so to speak, is being made by the organism to maintain the difference of temperature between its surface and its surroundings, on which the rate of heat loss by radiation and conduction depends. . . . In dry air the sweat evaporates freely and cools the skin, while in moist air, although according to Rubner, the loss of heat by radiation and conduction is increased, the loss of heat by evaporation of sweat is diminished in still greater degree. In saturated air at the body

[5] Weather Influences.

[6] A Manual of Physiology.

temperature no loss of heat by perspiration or by evaporation from the pulmonary surface is possible."

Landois[7] states that a man is just able to work in an atmosphere at a temperature of 31° C., and almost completely saturated with watery vapor. Crombie states that Europeans in Bengal have an average of 0.41° more temperature than at home.

From these facts what must be the condition of the physical organism in the Philippines is apparent. The high temperature which is prevalent most of the time causes dilatation of the arteries of the skin with sweating. On account of the high relative humidity, evaporation from the skin is prevented to a considerable extent, often to such a degree that the organism is unable to keep the temperature down to normal. The resulting increased temperature of the blood still farther increases the dilatation of the arterioles of the skin and more blood flows through the skin to be cooled. This process is almost continuous, as seen by the excessive and almost constant perspiration which continues throughout the day and usually well into the morning hours.

The abnormal dilatation of the arterioles of the skin must cause a more or less marked anemia of the internal organs. There can be no doubt that such an anemia is produced. Kellogg[8] states that the muscles, the portal system, and the skin each is capable under certain conditions of retaining a large share of all the blood in the body, the skin by percussion, friction, reaction from cold and heat, especially the latter.

Signs of anemia of the central nervous system are observed very frequently in the Philippines. Vertigo and faintness are very prevalent phenomena, especially among women, and inability to remember and concentrate one's attention are often observed. Woodruff cites several instances of inability to think or remember without taking rest in the recumbent position. All such symptoms are most easily explained by the fact that the central nervous system is lacking in sufficient blood supply. The same cause may account for the gastric disorders that are so frequent. Granting, therefore, that a certain amount of anemia of the central nervous system exists, the question now presents itself, Is the anemia thus produced sufficient to cause, or to have some part in causing, the neurasthenia so characteristic of the tropics? I believe that such anemia is sufficient for the following reasons:

1. If temporary loss of memory can be induced by cerebral anemia it is reasonable to suppose that such anemia long continued may cause more or less permanent nervous derangement.

2. We know that if the various portions of the body are not supplied by a sufficient amount of blood they deteriorate or degenerate. The muscles grow small if they are not exercised sufficiently to cause

[7] A Text-book of Human Physiology. [8] Rational Hydrotherapy.

an increased flow of blood through them. If the laborer does not take sufficient rest after meals, a greater share of blood will remain in the muscles and digestive disturbances often follow because too little blood is allowed for the gastrointestinal digestion. Reasoning from analogy, is it not likely that the anemia of the central nervous system will cause a state of nervous exhaustion?

3. Several observers have noted that the nearer a white man approaches the size of the native, the better he seems able to resist the evil effects of a sojourn in the tropics. There are no statistics on record as to the size of men affected with neurasthenia, but from personal observation of those most markedly affected with nerve exhaustion, the large man seems to predominate.

The following quotation from a recent letter from Major Woodruff is much to the point: Speaking of neurasthenia, he says: "In my book I mention the facts that men of large musculature are more affected; since that was written I have learned of four new cases of these giants, all of whom have come back with dilated hearts and neurasthenia. In recent conversation with an Englishman from Ceylon, I learn that the big men break down, as a rule, and that the survivors who spend many years in India are, like Lord Roberts, the little fellows. I do not think there is any doubt that bigness makes one more susceptible, and that the nearer we approach the size of the native the better." The fact that large men are more susceptible to neurasthenia supports the anemia theory of tropical exhaustion.

Large men, especially those with large muscles, are more likely to suffer with anemia of the central system than smaller men, as is apparent from a calculation that I have made:

The area of the skin surface of a large man (six feet tall and weighing 175 pounds) was found to be 2677.6 cubic inches, and that of a small man (five feet, two inches tall weighing 114 pounds) 2272.8 cubic inches. In proportion to the weight of the two men, the skin surface of the large man was found to be 23 per cent. less than that of the small man. This deficiency of skin surface of nearly 25 per cent. makes it more difficult for these large men to cool off. In order to make up the deficiency more blood must be pumped through the skin or the cooling process must be kept up for a longer time. In either case it means an anemia of the central nervous system more pronounced than in men of smaller size and with a greater proportional skin surface. To force such an increased quantity of blood through the skin to be cooled, the heart is overworked. Hence, the extreme neurasthenia and cardiac dilatation seen in so many large men coming home from the Philippines.

This theory that the anemia of the central nervous system produced by excessive heat and humidity has some part in causing the neurasthenias of the tropics, has not been proved experimentally,

but is presented as a plausible working hypothesis upon which may be based future study.

As regards acclimation, we cannot say that people are acclimated to a certain locality unless they can live there with comfort to themselves, their children, and their children's children. It does not follow, as some authors say, that because a certain proportion of the American people may live in the tropics with apparent comfort and good health for a certain time that acclimation is possible, and that it is possible for the white race to colonize in the tropics. After only a few years of residence in the tropics the white people become a race of neurasthenics. We know that neurasthenia is but a step toward degeneracy. What, therefore, will be the condition of the children of these people or of their grandchildren?

Born of neurasthenic parents, they will inherit an organism lacking in nerve force; being forced to live in an enervating climate, their small reserve will be still farther drawn upon, and in a generation or two there will result a race with little resemblance to the mother stock, small, puny, weak-minded, in fact a degenerate race which would soon cease to exist if new stock did not continually come from the home land.

PROPHYLAXIS AND TREATMENT. It is evident from what I have said that certain persons should avoid the tropics. These include blondes, large men with great musculature, those with tuberculous tendencies, those having disorders of the stomach and intestines, neurasthenics (including those suffering with headaches, insomnia, hysteria, insanity, etc.), women, children, and old men.

Many Americans contract pulmonary tuberculosis in the Philippines, and unless they change their climatic surroundings at once, they decline rapidly. The chances of contracting tuberculosis are greater than in America, in spite of the out-of-door life, because: (1) The natural resistance of the organism is greatly diminished, and (2) the disease is much more prevalent in the Islands.

In the United States, the yearly death-rate for pulmonary tuberculosis per 1000 inhabitants runs from 0.7 in the country districts, to 1.7 in some of our larger cities, while in Manila it is over 5.[9] The Philippine Civil Government has provided no hospital or sanatorium for the tuberculous sick, so that without treatment they are allowed at large, and infect the streets and their homes with their sputum.

[9] A study of tuberculosis in the Bilibid Prison teaches a lesson as to the effect of overcrowding on this disease. This prison was originally intended for from 1000 to 1200 prisoners. In 1902 the number of prisoners averaged about 2000, and during that time the yearly death-rate from pulmonary tuberculosis per 1000 was 9.5. During the latter part of 1904 the number of prisoners was very much increased. For the twelve months ended October, 1905, the average was approximately 3900. During that year the yearly death-rate from tuberculosis per 1000 was over 52, or more than ten times the usual death-rate for that disease outside the prison. A moderate increase of pulmonary tuberculosis would be expected during confinement, but when during one year out of 3900 prisoners over 200 die of this disease something is radically wrong.

Nervous diseases are aggravated in the tropics. Insanity is much more prevalent in the Philippines than in America. In the report of the Surgeon General of the United States Army, for 1902,[10] we find that for the year ended June 3, 1901, the insanity rate among soldiers per 1000 for those at home was 1.38, while in the Philippines it was 2.79 for regulars and 3.9 for volunteers.

Old age, as well as childhood, contraindicates a sojourn in the tropics. Woodruff's statistics show that the best age is from twenty to thirty or thirty-five years. "No man over fifty-five should dare to go there except for a short visit."

Rules of tropical hygiene may be considered under the following heads: (1) The avoidance of the direct rays of the sun; (2) the avoidance of excessive heat; (3) food and its preparation; and (4) excessive labor and long hours.

1. The actinic rays may be avoided, to a certain extent, (1) by exposing one's self to the sun as little as possible; and (2) by employing proper protection and clothing. Panama hats and the Philippino straw hats afford inadequate protection for the head. When compelled to go in the sun, a black umbrella should be used, or better still, one should be provided with a broad-brimmed cork helmet which will not allow the actinic rays to penetrate.

The clothing is important. Materials should be used of sufficient opacity to prevent as much as possible the penetration of the actinic rays, but should be light enough so that the process of cooling off be not interfered with. Both theory and practice demonstrate that the outer garments should be white, since this color absorbs less heat than darker colors. The color which shows the greatest opacity to light rays is black. The underclothing, therefore, should be black and of a light material, preferably linen. During the cool evenings of the winter, flannel underclothing may be worn to prevent the too rapid cooling.

Major Woodruff calls attention to the unsuitability of the Philippine houses for Americans. Not enough provision is made to avoid the excessive light. The houses should be built with large, shady verandas, the roofs of which should slope well down, so that those sitting on the porch do not get the glare from the sky. The windows should be protected with awnings and there should be no iron roofs to reflect the heat and make the house no less than a furnace.

The midday siesta should not be forgotten. The avoidance of muscular activity for a few hours during the hottest portion of the day lessens excessive heat production; and the strong midday light rays are avoided.

2. To avoid excessive heat in the tropics is not always possible, but during the hottest months, May and June, it is advisable, indeed it is almost a necessity, that Americans sojourn in the cool regions

[10] Report of Surgeon-General, U. S. Army, 1902.

of Japan or in Baguio, the summer capital in the mountains of Benguet.

3. The nervous exhaustion so prevalent demands the most nourishing of diets. It is a mistaken notion that dwellers in the tropics need little meat. More meat is needed than in our temperate climate. To avoid intestinal infection, all food must be aseptically prepared. Green vegetables of all kinds are dangerous, and it is doubtful if fruits even with thick coverings are safe. All water used for drinking purposes should be previously boiled, and while in a boiling state placed in retainers under lock and key until ready for use. Distilled water should not be considered safe, but should also be boiled, since a recent epidemic of amœbic dysentery in Manila was traced to an infected distilling plant.

If bottled water is used the brand must be selected with great care, as a great deal of the bottled water for sale in Manila is unreliable. The possibility of amœbic infection from ice washed with hydrant water and the rinsing of glasses in hydrant water without properly drying, must be borne in mind.

Americans must avoid excessive labor and long hours in the tropics. Manual labor in the sun is out of the question. Light manual labor in airy shops is less depressing, but should be limited to five hours daily. Mental work also is much more fatiguing than in America. Prolonged concentration of the mind is almost impossible. For the Philippine Civil Government to require more than five hours daily work by its employés means a less efficient service and an early breakdown. The statement made by some writers that American employés are able to do more work in the Philippines than at home is absurd in the extreme.

As regards treatment, early change of climate is usually all that is necessary. It is remarkable what a great change is produced in the patient's condition by a few months in Japan or a trip across the Pacific.

EXPERIMENTAL ARTERIAL DEGENERATION.

By Joseph L. Miller, M.D.,

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The first successful experimental arterial degeneration should be credited to Lion and Gilbert,[1] who, in 1889, produced changes in the media by repeated intravenous injections of micro-organisms or their toxins. These changes were described as sclerocalcareous

[1] Des séances de la Soc. de biol., October 12, 1889.

and were apparently of the same character as those produced subsequently by adrenalin. Therese and Crocq[2] later verified these results. The next successful attempt recorded was by von Eiselberg[3] who, in 1901, reported arterial changes, very similar in nature, in thyroidectomized animals. Josue,[4] however, in 1903, following his successful attempts with adrenalin, imparted the first real stimulus to work along this line. He gave rabbits daily, for a few weeks, intravenous injections of adrenalin chloride and was able to produce areas of calcification in the thoracic aorta. Macroscopically, these appeared as small depressed areas, circular in outline, the floor being thin, at times showing aneurysmal bulging or distinct aneurysms. Microscopically, as has been shown especially by Zeigler,[5] Erb,[6] and Stanton and Pearce,[7] there is primarily a degeneration of the muscle fibers in the media, the intervening elastic fibers losing their wavy outline but otherwise not undergoing any change. Lime salts are rapidly deposited in the area of muscle degeneration, the resulting rigidity of the vessel wall leading to transverse fracture of the elastic fiber. The process is thus confined primarily to the muscle fibers, the elastic tissue being secondarily involved. The adventitia and intima are not involved, except in the process of repair, when, as has been demonstrated by Stanton and Pearce, the defect in the wall is obliterated by cells arising from the intima. The degenerated process is confined chiefly to the thoracic aorta. The renal and mesenteric vessels were also involved in some of Erb's cases, and Fisher has reported a hemiplegia resulting from rupture of a cerebral vessel.

Josue's results have been verified by numerous investigators and have led to experimental work with other substances in order to see whether similar vascular changes may be produced. At the present writing, more or less extensive arterial degeneration has followed the intravenous injection of digalen,[8] nicotine,[9] phloridzin,[10] and various synthetic preparations resembling adrenalin, and the administration of lead salts[11] and tobacco[12] by the mouth.

It is quite remarkable how early these changes may occur and especially the rapidity with which lime salts are deposited. Braun[13] found macroscopic changes after five injections and microscopic

[2] Archiv. de Méd. exp., 1894, p. 583.
[3] Deutsch. Chirurgie, 1901, S. 47.
[4] Soc. de biol., Paris 1903, p. 137.
[5] Beiträge zur path. Anat. und allg. Path., Bd. lxxxiii, S. 229.
[6] Münch. med. Woch, 1905, S. 829.
[7] Jour. Exp. Med., 1906, p. 74.
[8] Deutsch. med. Woch., 1905, S. 1714.
[9] Amer. Med., 1906, p. 105.
[10] Gesellschaft f. inn. Med., Wien, November 9, 1905.
[11] Compt, rend. Soc. de biol., 1903, p. 1659.
[12] Gazz. d. Osp., Milano, 1905.
[13] Wien. klin. Woch., 1905, Nr. 6.

changes after two. Rzentkowski[14] reports calcification as early as the fifth day, and Zeigler the sixth day. On the other hand, daily injections repeated for several weeks give negative results in some cases, as there is apparently a marked variation in the individual resistance to these alterations. Apparently the age of the animal is an important factor, as Pic and Bonnamour[15] and later Pearce and Stanton found it much more difficult to produce degeneration in the vessels of young rabbits than in old ones.

The experimental production of these changes has introduced some other interesting problems, especially the question as to how these changes are produced and in what way they are related to arteriosclerosis in man.

Many theories have been advanced as to the direct cause of the process, as high tension, toxic influence, spasm of the vasovasorum, and cachexia. Fisher[16] believed the associated cachexia due to the prolonged use of the adrenalin was an important factor. Against this view is the rapidity of the process in many cases, also that no apparent cachexia can be detected in some animals in which marked calcification may be found. Erb considered spasm of the vasovasorum as an important factor. As the adventitia, as well as the media, receives its blood supply through this source, it is probable that both would be affected in case the changes originated in this way. A microscopic study has also failed to furnish any evidence directly supporting this way. The toxic and high tension theories have the strongest support at the present time.

In favor of the high-tension view is the sudden and marked rise in pressure following the injection of adrenalin. The strain thrown suddenly upon the vessel wall is very great, and might, as a result of trauma, lead to the changes in the media. It does not necessarily follow that, inasmuch as high pressure is a factor in the arteriosclerosis in man, it is necessarily associated with that in rabbits, since the two processes are usually different in character, affecting different coats in the vessel. Many, although not all, of the substances capable of producing these changes increase blood pressure. Phloridzin, with which Kolisch produced characteristic changes, does not increase pressure, the effect if any being to depress it. Bacterial toxins lower the pressure and lead per os has no demonstrable effect. Ludwig Braun thought he had demonstrated that increase in pressure is not the chief factor in adrenalin arteriosclerosis by attempting to inhibit the pressure effect through administering simultaneously amyl nitrite. He reports prompt and marked arterial changes in rabbits treated in this manner. If later experiments verified his results, we would have here the best of evidence that

[14] Berl. klin. Woch., 1904, xxxi.
[15] Compt. rend. Soc. de biol., 1905, p. 219.
[16] Münch. med. Woch., January 3, 1905.

increase in pressure is at least not the only cause. Our experiments have shown that amyl nitrite even when given very freely does not inhibit the action of adrenalin. If the amyl nitrite precedes the adrenalin there is an initial fall but not a subsequent sharp rise; if they are injected simultaneously, the adrenalin acts so much more quickly that the rise takes place anyway; and it may be that the degree of change rather than the absolute height of pressure would produce arterial trauma. Sturli's[17] positive results with the subcutaneous use of adrenalin has also been advanced as evidence that the changes are toxic, for the reason that when given in this manner it does not increase pressure. In our experiment it has been demonstrated that 1 c.c. subcutaneously frequently causes a rise in pressure almost as great as when given intravenously, although the form of the curve is quite different. Meltzer and Auer[18] have shown also that in rare instances a moderate rise follows its subcutaneous use. In the light of these results, Sturli's proof is not convincing. Kulbs[19] and Josue after prolonged subcutaneous injections were unable to produce any arterial changes; however, the daily amount used was not very large. Intraperitoneally, adrenalin does not increase pressure, and Erb was unable to bring about any vessel changes after prolonged use in this manner. It might be mentioned before leaving this phase of the subject that Lissauer,[20] in order to prove that the changes are not due to high pressure alone, injected into rabbits 0.05 gm. per kilo of caffeine. This caused a rise in pressure of 60 mm., while adrenalin increased it 100 mm. He treated the animals for seven months, but was unable to produce vessel changes or heart hypertrophy.

There is considerable evidence that extracts of the suprarenal have a toxic action quite independent of their vasoconstriction effect. Large doses administered subcutaneously cause death with symptoms of asphyxia without any decided increase in blood pressure. Elliott[21] and Tuckett discovered that the suprarenal gland of guinea-pig contains a substance which causes rapid necrosis of the guinea-pig's tissues. This is present in the cortical portion of the gland and is therefore not the pressor substance. Paton and Drummond[22] determined that the subcutaneous injection of adrenalin produces cloudy swelling and desquamation in the convoluted tubules of the kidney and central necrosis of the liver similar to that produced by certain bacterial toxins. Foa[23] several years ago reported degenerative changes, especially in the kidney, following intravenous and subcutaneous use of a watery extract of the gland. He reports

[17] Wien. med. Presse, 1905. S. 544.
[18] Jour. Exper. Med., vol. vii, No. 1.
[19] Archiv. f. exp. Path., Bd. liii.
[20] Berl. klin. Woch., 1905, 3675.
[21] Referred to by Elliott, Eng. Jour. Physiology, vol. xxxii, p. 464
[22] Eng. Jour. Physiology, vol. xxxi, p. 81.
[23] Archiv. Ital. de Biol., xxv, p. 250.

that heating to 60° destroyed the substances causing tissue necrosis, but left the pressure substance intact.

A review of the above evidence enables us to say: First, that arterial changes of this character may be formed independent of an increase in pressure; second, there is evidence that the extract of suprarenal has a toxic action. No satisfactory evidence can be found, however, that these changes are solely the result of either pressure effect or toxic action. If the result of pressure, it is probably due to the sudden rise rather than the prolonged effect—as after the administration of adrenalin, the pressure returns to normal within three to six minutes. Erb has suggested that there is a permanent increase in pressure following the prolonged use of adrenalin and has found a pressure of 160 mm. in a rabbit after long-continued injections.

The second question to be discussed is the relation of these changes to those occurring in man. Under the term arteriosclerosis we have several distinct pathological processes. In the usual form there is a hyperplasia of the intima, the media showing very slight if any changes. Calcification, if it occurs, is in the intima. Fränkel[24] has described another type in the peripheral vessels in multiple neuritis, tabes, and general paresis. He found quite uniformly marked hypertrophy of the media, the lumen being often almost obliterated. By cutting the sciatic nerve in rabbits he was able to produce similar changes in the vessels of the extremity. He considers angiospasm as the chief factor in this group of cases. The syphilitic aortitis, which is usually considered under the general term of arteriosclerosis, is a focal process confined to the media. However, it is inflammatory in character and shows little tendency to calcification, but rather to cicatricial contraction. Finally, we have the vascular changes described by Monckeberg,[25] who studied especially the peripheral vessels in elderly people. Fifty-five of the cases studied had focal degeneration of the media with calcification, the overlying intima somewhat thickened. When, *intra vitam*, the radial was hard and tortuous the chief change was a medial calcification. He concludes that medial calcification is more frequent in the peripheral vessels than thickening of the intima alone. Monckeberg's findings, so far as I have been able to determine, have never been refuted. Although he has been unable to study the early changes, as has been done in the experimental work on rabbits, it must be admitted that the similarity of the two conditions is striking.

My experiments were instituted in the hope of throwing some light upon the cause of vascular change: (1) By administering adrenalin with some substance that would inhibit its pressure effect (2) by giving it a through channel that might allow its toxic effect

[24] Wien. klin. Woch, 1896, S. 147.
[25] Virchow's Archiv, Bd. clxxi, S. 141.

without its pressure action; (3) by attempting to destroy its toxic qualities and leaving the pressure substance intact; and (4) by producing experimental arterial degeneration with substances which have only a moderate pressure action.

Brodie and Dixon[26] have reported that apocodeine, an alkaloid obtained from codeine by dehydration, when injected into rabbits or dogs causes a fall in pressure due to paralysis of the vasomotor nerve cells. The blood pressure can only be lowered to a certain fixed point beyond which further injection either has no effect or causes a slight rise in pressure. These large doses inhibit the pressor action of adrenalin. We gave rabbits 30 to 40 mg. subcutaneously and produced a marked fall in pressure, then administered the adrenalin, and, contrary to Dixon's results, had a prompt and decided rise. When larger doses of apocodeine were used the animals succumbed and our experiments with this drug were abandoned. Adrenalin when administered after chrysotoxin, the active principle of ergot, is said to cause a fall in blood pressure. Our experiments here also failed to produce the desired results, as there was always a prompt rise following the use of the adrenalin. Amyl nitrite, nitroglycerin, and sodium nitrite were next used. All of this group produce a marked fall in the pressure; however, when followed by adrenalin, the characteristic rise occurs, which we are unable to prevent even when very large amounts of the above substance were given. Three minims of the 1 to 1000 adrenalin chloride solution was used intravenously. The resulting absolute pressure is much lower than when these vasodilators are not given, but the degree of increase is practically unchanged. Although we are unable to inhibit the pressure action by this means, four rabbits were given this combined treatment. The abs lute pressure being much less, negative results would favor the extremely high pressure as an important factor in the arterial changes. Amyl nitrite was selected as the most satisfactory of this group. At first, three minims of this was combined with an equal amount of the adrenalin and injected directly into the ear vein. As this set up a marked cellulitis, a mask was made and the rabbit inhaled the amyl nitrite while receiving the injection of adrenalin. Experimentally, it was found that by this method there would be a fall in pressure of about 40 mm.; when the amyl nitrite was inhaled, following the injection of the adrenalin, there would be the characteristic rise averaging about 80 mm., the blood pressure reaching on an average 140 mm., the normal pressure of the rabbit being about 100 mm. If amyl nitrite was not given, adrenalin would bring the pressure up to about 180 mm. By this means we were enabled to lessen the rise in pressure by about half without interfering with any possible toxic action of the adrenalin. The four rabbits received twenty-five injections of

[26] Eng. Jour. Phys., vol. xxx, p. 476.

three minims each extending over a period of thirty-five days. At the end of this time they were chloroformed and the heart, thoracic and abdominal aorta examined. None of the vessels showed any gross or microscopic evidence of arterial degeneration nor was there any evidence of heart hypertrophy. These results do not agree with Braun's. His method of procedure, however, was different, as he mixed and injected both simultaneously. When this is done the action of the adrenalin, being more prompt than the amyl nitrite, an initial fall did not occur, as was the case when amyl nitrite was inhaled. These negative results with this small number of animals should not be looked upon as conclusive; it is, however, suggestive, as in my experimental work with adrenalin alone an average of at least half of the animals showed marked arterial changes. If in the light of the small number of animals used we should be allowed to draw any conclusions from this experiment it would be that high pressure is a factor in producing arterial changes.

Following the suggestion of Foa, two rabbits were given intravenous injections of adrenalin chloride that had been previously heated to 70° C. This does not lessen its pressure action, but Foa thought it destroyed its toxic effect. We must bear in mind, however, that he used a watery extract of the gland and not the active principle. These animals received twenty-five injections of three minims each, over a period of five weeks. The autopsy showed slight changes in the thoracic aorta of one; very marked changes in the other. Thus it is seen that if the vascular change caused by adrenalin were due to a toxic substance it is not destroyed by heat.

Two animals were given daily subcutaneous injections of 1 c.c. of adrenalin for a period of five weeks. One animal became very much emaciated, due probably to a suppurative process in one eye and should have been a fit subject in which to produce arterial degeneration. However, in neither of them were there any vascular changes. These results are in accordance with the majority of those who have used adrenalin in this way. Inasmuch as a marked rise in pressure following the subcutaneous injection is quite inconstant, it is possible that Sturli's positive results might have been due to the use of rabbits that responded by a marked rise.

Two animals were given intravenous injections of 1.5 mg. of nicotine every day for six weeks. One of these showed slight but typical changes in the ascending aorta. Nicotine given in these doses intravenously causes first a slight fall in pressure, after a few seconds a sharp and marked rise, the character of the curve resembling that of adrenalin. Arterial changes due to its use may readily be considered a result of its pressure effect. It would be of interest to determine if tobacco given per os, as in Boveri's experiments, causes a rise in pressure; if negative, it would speak for the probable toxic character of the lesion.

At the suggestion of Dr. A. P. Matthews, of the University of Chicago, four animals were given intravenous injections of physostigmin. In doses of 1 mg. this causes a gradual and moderate rise in pressure, which returns to normal in six to eight minutes. The action is a direct muscular one, affecting both the heart and vessels. The animals received daily 1 mg. for a period of eight weeks. Two of these showed a single focus of degeneration in the descending aorta. The gross appearance differs slightly from that of adrenalin. There was a distinct, single, mound-like elevation of the wall; in one the calcareous deposits could be readily detected by the finger; in the other there was merely a sense of greater resistance than in the surrounding wall. Microscopically the changes have not yet been carefully studied.

Very interesting results were obtained from the use of barium chloride. When 1 mg. is injected intravenously into a rabbit there is a gradual and moderate rise in pressure of 25 to 35 mm. This rise is maintained for a half hour or more, and is the result of a combined action upon the heart and bloodvessels. Compared to adrenalin the rise is more gradual, much less in degree, and much more prolonged. Three rabbits were given 1 mg. of barium chloride intravenously. One of them received twenty-two injections within fifty-six days; the others twenty-two injections each, extending over thirty-five days. The animal treated for eight weeks showed a single mound-shaped elevation, the size of a pinhead, in the transverse aorta. Macroscopically there was no evidence of calcification. One of the other rabbits did not show anything abnormal; the other, in the aorta just above the valves, had numerous small elevations. These varied in size from a small pinhead to two or three times this diameter. They were soft to the touch. Under a hand-glass they appeared as mound-like elevations irregular in outline and furrowed. Over these areas the glistening appearance of the intima was lost, being replaced by a dull gelatinous appearance. The picture differed from any that I have seen following the use of adrenalin, where from the onset the process is a destructive one, no thickening of the wall being observed. The microscopic changes differ quite distinctly from those previously described. The changes appear to be confined chiefly to the subendothelial layer of the intima. The differentiation between intima and media is not sharply defined in the rabbit's aorta, as the amount of muscle tissue in the latter is slight. It was the opinion, however, of Dr. Bensley, of the Chicago University, who kindly examined my specimens, that the changes to be described are in the intima rather than the media. This is also the impression gained from the examination under low magnification, as the area of involvement appears as a distinct narrow band paralleling the endothelium. The fine wavy outline of the elastic fibers in the involved areas is replaced by a marked tortuosity.

The interspaces between the fibers are markedly increased and it is this apparently that leads to the thickening of the wall. The fibers in the adjacent media are often compressed as are also often some of the overlying fibers of the intima. The fibers were furthermore irregularly swollen and altered in their staining qualities. With iron-hematoxylin they appear intensely black, with the toluidin-blue sections of the fibers stain giving a beaded appearance. Where calcification occurs the lime salts are deposited between the fibers. These changes require further study, which I hope soon to carry out on another series of rabbits. Of interest, however, is the demonstration of changes in the elastic fibers and the possibility of the process being chiefly confined to the intima. Certainly, the changes in many respects differ from those following the use of adrenalin. No noticeable heart hypertrophy was observed in these animals.

In conclusion we can say there are a number of substances capable of producing vascular changes. At the present time this list includes bacterial toxins, extract of suprarenal and various similar synthetical preparations, phloridzin, digitalis, nicotine, physostigmin, barium chloride, and lead. The majority, but not all of these, increase the pressure. This may be largely accounted for by the fact that those who have done experimental work have selected those substances that increase pressure, as they have considered this an important factor in the change. More work should be done with other groups of substances, and then it may be demonstrated that increased pressure is not essential for the changes.

Our work has added two new substances to the list of those capable of producing arterial changes—physostigmin and barium chloride. Both of these cause an arterial degeneration, the latter producing changes apparently differing from adrenalin. We have demonstrated that the subcutaneous injection of adrenalin may cause a very distinct rise in pressure, thus annulling the evidence, that when arterial degeneration follows the subcutaneous use of this drug, it is necessarily due to its toxic rather than its pressure effect. We were also unable to inhibit the pressure action of the adrenalin by the use of amyl nitrite. For this reason arterial changes following the combined use of these substances does not prove that the process is toxic, as was maintained by Braun.

I wish to express my gratitude to Drs. S. A. Matthews, and A. P. Matthews of the department of physiology, and also the various members of the department of anatomy of the University of Chicago, for their very valuable assistance.

SOME CONGENITAL ANOMALIES OF THE HANDS AND FEET.

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The accompanying plates illustrate some congenital anomalies which came to our notice at the Presbyterian Hospital in New York during the last year. For the excellent photographs I am indebted to Mr. Ira L. Simms, of the *x*-ray Laboratory of the Hospital.

Case I.—The ordinary photographs of the hands show prominence of the third and fourth metacarpal bones, which in the *x*-ray photographs are seen to be fused together. The ring fingers articulate at an angle with these consolidated bones. Note also the breadth of the last phalanges of the thumbs, where there were evidently attempts made to form two distinct distal phalanges in each thumb. This patient was a mechanic and suffered no disability.

Case II.—Illustrates a condition of webbing of the middle and ring fingers of each hand. In the left hand the bones of an extra digit are well-formed, though they are small. In the right hand this extra digit has not become separated from the ring finger. There is also absence of a joint between the first and the second phalanges of the right hand.

Case III.—The two plates represent the hands and feet of the same patient, each of which has six digits, except the right hand, which is normal. The extra digit on the left hand is formed by a branching of the innermost metacarpal bone at its distal extremity. The extra digit which has three phalanges is an extra ring finger. Each foot of this patient has an extra digit on the outer side of the foot, each formed by a branching of the fifth metatarsal bone. Note the difference in the manner of this branching on the two sides.

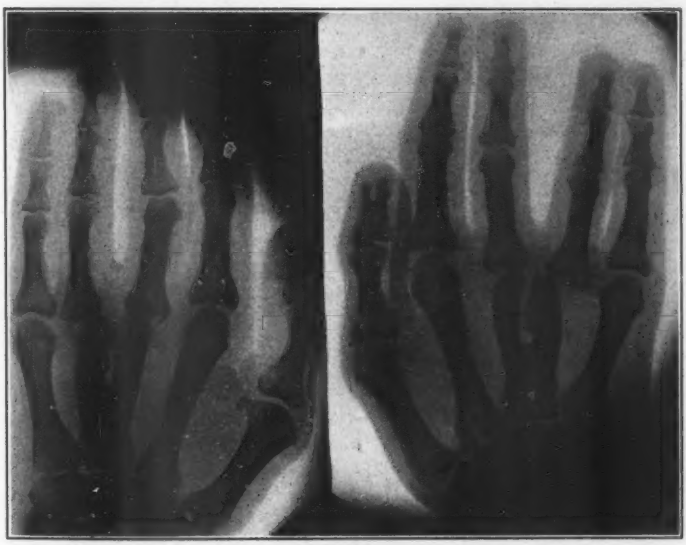
Case IV.—Supernumerary left thumb. The last two phalanges are ankylosed at the distal joint and arise from a branched metacarpal bone; note also the partial dislocation of the supernumerary portion on the metacarpal. The extra thumb is practically useless and in the way; the right thumb is normal.

Case V.—Represents congenital absence of one forearm and three fingers in a boy six years of age. The articular surface on lower end of the humerus is practically absent as are entirely the ulna and the radius. Below the humerus there is a carpal bone. Other carpal cartilages are probably present (*x*-rays do not show cartilage), and will ossify later, but at the present time only one carpal cartilage is ossified. The hand is repre-

sented by two fingers, which can be used by the boy to an astonishing extent in most useful ways. Motions at the wrist and

CASE I. –Left hand.

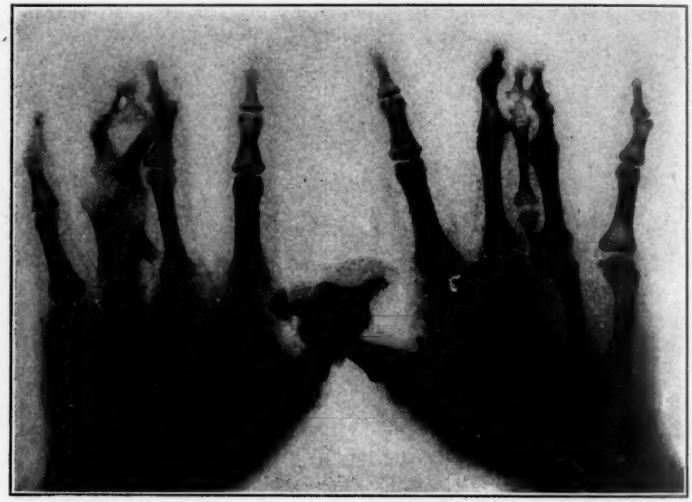
CASE I.—Right hand.



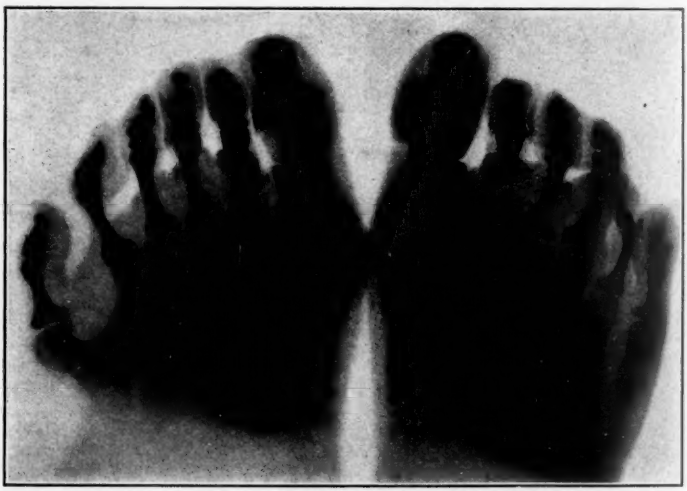
Left hand. CASE I. Right hand.

in the fingers are good. One of the fingers is evidently a thumb, for the following reason: by comparing the normal metacarpal

bones of the hands of a boy of ten in Case VI, we see that the normal epiphyseal line in the metacarpal bone of the thumb is situated on



Right hand. Case II. Left hand.

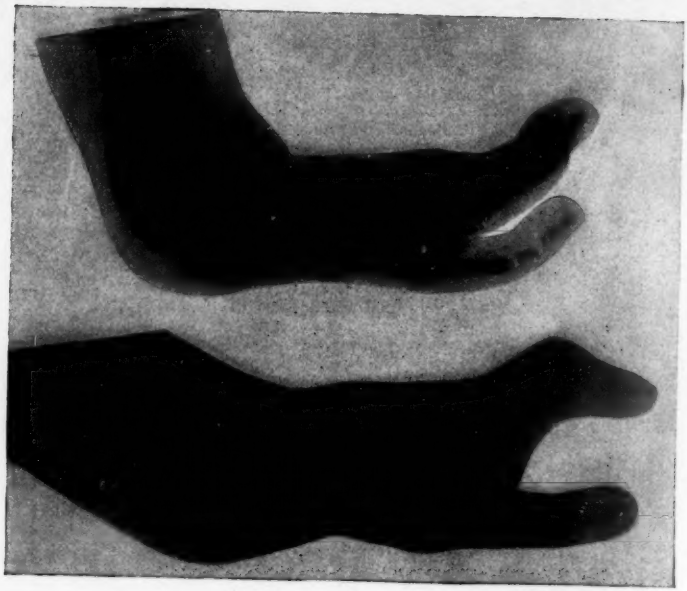


Case III.—Feet.

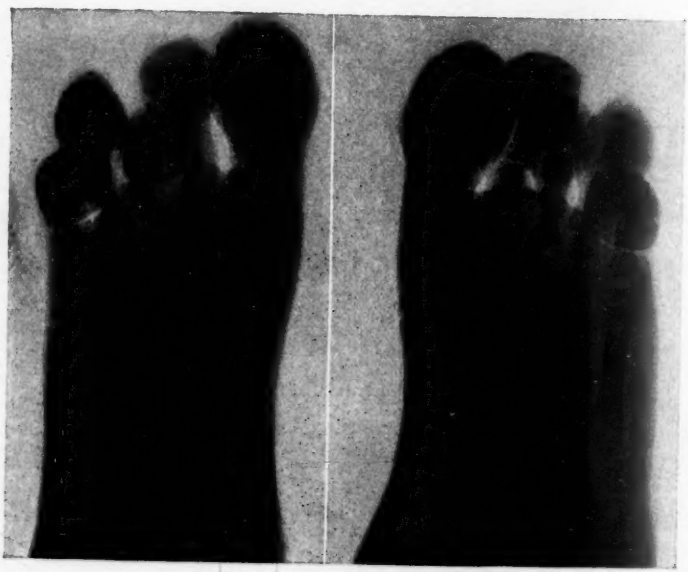
the wrist end of the metacarpal, while in the metacarpals of all the fingers the epiphyseal lines are situated on the phalangeal ends.

Right hand. CASE III. Left hand.

CASE IV.

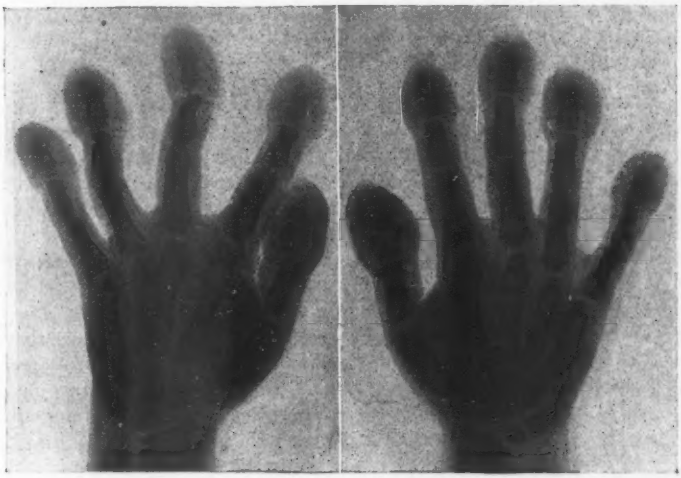


Case V.



Case VI.

In Case V we see that in one metacarpal the epiphyseal line is on the phalangeal end, so that we may say this is a true finger while the other is a thumb, because its epiphyseal line is on the wrist end of its metacarpal. Note also the unusual fact of there being two epiphyseal lines on the thumb metacarpal. The *x*-ray photographs of the two fingers were taken at different angles. The opposite forearm and hand are normal.



CASE VI.

CASE VI.—Hands and feet of a boy of ten, illustrating clubbing of the fingers and toes. The boy had fibrosis of one entire lung consecutive to an unresolved bronchopneumonia; nephritis also was present to a marked degree. Notice the feathery thickenings of the distal portions of the last phalangeal bones. The clubbing consists not only of thickening of the soft parts but also of the bones of the last phalanges, due to a productive periostitis.

THE STANDARDS AND WORK OF THE PHILADELPHIA PEDIATRIC SOCIETY'S MILK COMMISSION.

EMBODYING A REPLY TO A CRITICISM BY DR. A. H. STEWART, OF THE PHILADELPHIA BUREAU OF HEALTH.[1]

By Samuel McC. Hamill, M.D.,

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The Milk Commission of the Philadelphia Pediatric Society was appointed in January, 1899. A close relationship between the milk supply and the high infant mortality, especially in the summer months, had been recognized for many years. Many efforts had been made to improve the conditions governing milk production. Pasteurization and sterilization had been resorted to, the various proprietory foods had been extensively used, and all without any material influence upon the death rate.

It was thought by the Pediatric Society that something might be accomplished in this line by interesting some of the modern well-equipped dairies in the production of a milk of a high degree of cleanliness, with a low bacterial content, and constant chemical make-up. With this end in view, a Committee was appointed to investigate the dairies of this class supplying milk to Philadelphia, and to consult with milk producers and veterinarians, as to what should constitute the standards under which a Milk Commission should work.

The report of this Committee, made to the Society in January 1900, embodied the following standards:

Bacteriological. The bacteriologist shall procure a specimen of milk from the dairy, or, preferably, from delivery wagons, at intervals to be arranged by the Commission and the dairy, but in no case at a longer interval than one month. The exact time of the procuring shall be without previous notice to the dairy. He shall test this milk for the number and nature of the bacteria present in it, to the extent which the needs of safe milk demand. He shall also make a microscopic examination of the milk for pus cells. Milk free from pus and injurious germs and having not more than 10,000 germs of any kind or kinds to the cubic centimeter shall be considered up to the required standard of purity.

Chemical. The chemist shall, in similar manner, procure and examine the milk for the percentages of proteids, fat, sugar, mineral matter, and water present. He shall also test its chemical reaction and specific gravity, and shall examine it for the presence

[1] Amer. Jour. Med. Sci., 1906, cxxxi, 625.

of foreign or other matters, or of chemicals added as preservatives. Standard milk shall range from 1029 to 1034 specific gravity, be neutral or very faintly acid in reaction, contain not less than from 3.5 per cent. to 4.5 per cent. proteid, and from 4 per cent. to 5 per cent. sugar, and not less than 3.5 per cent. to 4.5 per cent. fat, and shall be free from all contaminating matter and from all addition of chemical substances or coloring matters. Richness of cream in fat shall be specified, and shall vary not more than 1 per cent. above or below the figure named in selling. Neither milk nor cream shall have been subjected to heat before the examination has been made, nor at any time unless so announced to the consumer.

VETERINARIAN. The Veterinary Inspector shall, at intervals equal to those of the bacteriologist and chemist, and without previous warning to the dairy, inspect the cleanliness of the dairy in general, the care and cleanliness observed in milking, the care of the various utensils employed, the nature and quality of the food used, and all other matters of a hygienic nature bearing upon the health of the cows and the cleanliness of the milk, including also, as far as possible, the inquiry into the health of the employés on their farms. He shall also see that the cows are free from tuberculosis or other disease.

DUTIES OF EXPERTS. The experts shall make their examinations when, and only when, notified to do so by the Commission. Any dairy, the milk of which shall be found by the examiners to be up to the standard of the Commission, shall receive certificates from the Commission.

In case an examination shows the milk not up to the standard, the dairy may have a re-examination made within a week, or within a short time, at the discretion of the Commission.

Milk furnished by the producers to whom certificates have been issued shall be delivered to consumers in glass bottles hermetically sealed in a manner satisfactory to the Commission. In addition to the sealing, and as a guarantee to the consumer that the examination has been regularly conducted, there shall be pasted over the mouth of the jar, or handed to the consumer with every jar, according to the discretion of the Commission, a certificate slip which shall read as follows:

CERTIFICATE OF THE PHILADELPHIA PEDIATRIC SOCIETY'S MILK COMMISSION.

Milk from the dairy of Mr. .....has been recently examined by the experts of the Milk Commission and found to be fully up to the required standards. Another examination is to be made within a month, and, if satisfactory, new labels for the bottles will be issued, dated.....

Notice the dates.

This report was approved by the Society and was adopted as the standard of the Commission. Since its adoption it has been changed in the following particulars:

1. The method originally adopted, for the collection of the samples for examination by the experts, was open to the following objections: It was impossible for either of them to obtain samples from the delivery wagons without previously notifying them to call at their laboratories, and it was equally impossible to secure reliable messengers to carry the milk to them from the delivery stations. At the suggestion of Prof. R. A. Pearson, of Cornell University, then General Manager of the Walker-Gordon Company, it was decided to require the producer, or his agent, to make daily deliveries of samples of milk to the house of the Secretary, thus enabling the Commission to select samples for examination at its discretion. Otherwise the bacteriological requirements remain the same, save that the Commission now certifies to cream, the conditions governing its certification being the same as those for milk, except that it is allowed a bacterial content of 25,000 to the cubic centimeter.

2. The chemist, instead of receiving samples direct from the distributer, examines the samples previously studied by the bacteriologist. The specific gravity of the milk is no longer determined, the acidity of the milk is definitely determined, the allowed variation of the proteid content has been changed to from 3 per cent. to 4 per cent., and the variation in the fat content of the creams has been permitted to vary 2 per cent. on either side of the percentage specified on the bottles. The Commission now certifies to 5 per cent. fat milks, allowing the same variation as in the case of the 4 per cent. milks.

3. The certificates issued to the producers are now placed between the pulp, and tinfoil or paper caps, covering the top of the jar.

These standards, in the experience of the Commission, have proved entirely satisfactory. Some of the dairies which have been under the certification of the Commission since its organization were unable to maintain these standards. These have either been dropped or withdrawn from our certification. Some others, whilst never producing a milk of high bacterial content, have had some difficulty in meeting our requirements, and all have failed occasionally.

The chemical and veterinary requirements have been met more satisfactorily than the bacteriological. There have been practically no failures in the proteid content since the variation of from 3 per cent. to 4 per cent. was determined upon. One of the dairies, producing a 4 per cent. fat milk, had some difficulty for a few months in keeping its milk within the required fat limits. By intelligent shifting of the herd and the introduction of new cows, this obstacle has been definitely overcome.

The Commission feels that it has accomplished even more than it had in mind at the time of its organization. It has not only put at the disposal of the Philadelphia public, milks and creams of a

high degree of purity, probably higher than that of any milks and creams produced in the world, but it has stimulated an interest in the pure milk question throughout the country. What is probably of more importance, certainly to Philadelphians, is the fact that it has stimulated the producers and dealers to take greater precautions in the preparation and distribution of milk, thereby elevating the standard of the general milk supply.

There has been an occasional criticism of the rigidity of the standards required by the Commission, and there has recently appeared an article by Dr. A. H. Stewart,[2] which the Commission considers unjust. The article in question is based upon the results of a long series of bacteriological examinations of the various milks receiving the certification of the Commission, together with one milk certified to by the Company producing it and one other which withdraw from the certification of the Commission during the course of these examinations.

Dr. Stewart's article would have been of more practical and scientific value had it contained a definite description of the methods pursued in reaching his results; the manner of production of the media; the temperature at which the plates were incubated; the length of time of the incubation, etc.; a statement of the principle upon which he determines what number of leukocytes in the milk constitutes pus, and especially the exact method by which the inspectors of the Bureau of Health received and conveyed to the laboratories the samples which were examined.

In making his bacterial counts, Dr. Stewart presumably, although he does not so state, made one examination immediately upon the receipt of the samples and another at the end of twenty-four hours. The second examination does not concern the Commission, inasmuch as the keeping of the milk after its delivery is a responsibility which must be assumed by the consumer and is, therefore, beyond the jurisdiction of the Commission. The only comment we need make thereon is that the results obtained would seem to reflect upon the manner in which Dr. Stewart kept the milks which he examined.

As to the manner of collecting the milk we would say that, unless the milk was placed on ice and kept on ice from the time it was accepted from the dealer until the time of the examination, the results of the bacteriological counts would prove unjust to both the producer and dealer. It is the custom of the Commission to have all samples delivered to the house of the Secretary under exactly the same conditions governing the delivery to the ordinary consumer. When the milk is so delivered the responsibility of the producer and the dealer ceases. Recognizing this, all samples are immediately placed upon and kept on ice until the bacteriologist's

[2] Amer. Jour. Med. Sci., 1906. cxxxi, 625.

examination is made, in order to hold the bacterial content, as nearly as possible, the same as at the time of delivery.

Let us now consider the results of Dr. Stewart's bacteriological examinations:

In the case of Dairy No. I (following Dr. Stewart's system of numbering) he made fifty-four examinations between July 18, 1904, and August 24, 1905. Of this number, he condemned 31 (57.4 per cent.), seven for containing pus cells—which means that he considered all samples to contain pus showing a leukocyte count above 100,000 per cubic centimeter; seven for containing streptococci; and twenty-nine for containing bacteria in excess of 10,000 per cubic centimeter—the standard required by the Commission. The samples showing bacteria present in excess of 10,000 per cubic centimeter gave the following counts: 10,200; 10,500; 11,000; 11,300; 11,700; 12,320; 14,600 twice; 16,200; 16,300; 16,500; 18,000; 27,000; 49,700; 72,000; 86,260; 93,000; 94,000; 102,400; 113,000; 117,000; 120,000; 132,750; 150,000; 200,000; 279,000; 390,000; 500,000; 770,000; in other words eleven of these twenty-nine samples contained less than 20,000 bacteria per cubic centimeter and eleven samples over 100,000 per cubic centimeter. In the experience of the Commission, as well as in the results of Dr. Stewart's work, this dairy has made the poorest showing of any of the dairies under the certification of the Commission.

Dairy No II, in Dr. Stewart's series, is the one which has not been under the certification of the Commission since September, 1904, and will therefore not be considered.

Dairy No III had fifty-four samples examined, of which two were condemned for pus cells—(140,000 and 104,000 leukocytes), one for streptococci, and, according to Dr. Stewart's statements, nine times for a bacterial content in excess of 10,000. In his column of results, however, there are but seven counts above 10,000. There is one of 10,000 and the seven others are as follows: 14,000; 15,670; 30,000; 37,500; 50,000; 78,000; 80,500; none above 100,000 and but two above 50,000.

The results of the examination of milk from Dairy No. IV, which Dr. Stewart wrongly states received the certificate of the Commission until June, 1905—the last issuance of certificates to this company having been in January, 1905—will not be considered after the date covered by the last certificates granted it, namely, up to February 10, 1905. This leaves twenty-eight examinations for consideration. In this number, streptococci were found four times, more than 100,000 leukocytes once, and bacteria in excess of 10,000 to the cubic centimeter eight times. Of this number, the counts were 11,250; 14,500; 15,500; 21,130; 24,000; 24,650; 27,400; 730,000. The count on two occasions only was above 25,000 and once only above 100,000.

Fifty-two examinations were made of the milk from Dairy No. V. Of this number, four were condemned for pus cells, none for strep-

tococci, and ten for a bacterial content in excess of 10,000 per cubic centimeter. In these instances the counts were as follows: 10,938; 11,200; 11,600; 12,000; 13,000; 14,800; 28,000; 29,300; 44,000; 77,000. In other words in only four instances was the bacterial content above 25,000 and but once above 50,000.

Fifty-two samples were examined from Dairy No. VI. Pus cells were never found; streptococci were present three times, and bacteria in excess of 10,000 per cubic centimeter nine times. Of this number the counts were 11,000; 11,500; 12,460; 14,300 (twice); 14,400; 15,800; 20,000; 60,000. In only one instance, therefore, was the number of 20,000 exceeded, and that count showed but 60,000 per cubic centimeter.

To sum up the results of these investigations, we find, excluding the results in Dairy No. I, that in 186 examinations the milk contained streptococci five times and exceeded a bacterial content of 10,000—thirty-four times, or in 18.28 per cent. In twenty-two instances the bacteria present numbered 25,000 or less; but three times more than 50,000, and but once more than 100,000; results which must be considered remarkable. Including Dairy I, which was formerly producing the poorest milk of any we certified to, but which is now doing excellent work, the number of examinations made was 240. In this number streptococci were present twelve times and the bacterial content of 10,000 was exceeded sixty-three times or in 16.25 per cent. In thirty-four instances the bacterial count was 25,000 or less, more than 50,000—eighteen times, and above 100,000—twelve times.

It should be observed that the twenty-nine failures of Dairy No. I to meet the bacteriological standard almost equals the combined failures—thirty-four—of the four other dairies, and that the number of instances in which streptococci were found—seven—exceeded by two the number in all of the other dairies. At the time of these examinations, the output of Dairy No. I amounted to less than one-third the total output of all the dairies. Any criticism, therefore, which is based upon the total results obtained from an examination of all the dairies is decidedly unfair to the four dairies making such excellent showings as well as to the Milk Commission.

In reference to what constitutes pus in milk, the views of the bacteriologist of the Milk Commission are not in accord with those of Dr. Stewart. The opinions which Dr. Ravenel holds in regard to this matter have been kindly written for me by him, and they are as follows:

"Pus in Milk. In taking up the work for the Milk Commission, the bacteriologist realized at once that the question of pus in milk was a most difficult one and the matter was laid before the Commission for discussion, and correspondence entered into with a number of authorities on milk. Leukocytes are practically always found in milk—so much so that we should consider them a normal content, or else hold the anomalous view that all milk comes from udders

which are inflamed to a greater or less extent. The pus cell is identical with the leukocyte, and is in fact the leukocyte after leaving the blood. At what point then must we consider leukocytes in the milk as an evidence of disease and call them pus? No standard has been fixed and those who have tried to do so have reached widely varying results, and the methods employed have, with a single exception (Doane), been wofully lacking in scientific accuracy. Dr. Stewart fixes arbitrarily 100,000 per cubic centimeter as an indication of pus, and has condemned many samples of milk on this standard. The normal leukocyte content of the blood in man is about 1,' 00,000. It is perfectly conceivable that the blood may contain 1,000,000 leukocytes and be healthy, while 100,000 in milk, or some other secretion, may mean pus and inflammation, but to assume this without further proofs than have been brought forward is unscientific, arbitrary, and unjust to the milk producer. It has not been shown by anyone that milk high in leukocytes has any injurious effect, nor has it been shown that their presence means *per se* inflammatory changes in the udder. Certain foods are said to produce a leukocytosis in milk. Induration of the udder can be produced by the injection of sterile water. Leukocytes may be had in enormous numbers in certain fluids by the introduction of sterile substances, as for example aleuronat. It seems perfectly possible that during the process of milking, leukocytes may be squeezed out, so to speak, from the lymph spaces into the milk. It has seemed to the bacteriologist, therefore, that a high leukocyte content should not of itself condemn a milk as containing pus. When it is found in a sample, plates made from the sample are carefully examined for the bacteria generally known to produce inflammation, such as streptococci and staphylococci. The presence of fibrin is also a most useful aid, as pointed out by Doane."

As has been previously remarked, Dr. Stewart does not state by what process he determines the presence of pus in milk, but, in the light of his figures, as Dr. Ravenel has said, one must assume that any milk containing more than 100,000 leukocytes to the cubic centimeter is a pus-containing milk. A number of attempts have been made to establish a standard by which it could be determined what number of leukocytes constitute pus. The earlier methods adopted for this purpose have been shown to be unreliable and up to the present time no standard has been reached.

The most recent, reliable, and comprehensive study that has been made on this subject emanates from the Maryland Agricultural Experimental Station and is presented by Charles F. Doane, referred to by Dr. Ravenel. This author does not consider it desirable to determine the presence of inflammation in the udder by the mere presence of a large number of leukocytes. We quote from his article in order not to misrepresent him and for purposes of clearness, as follows: "The presence of fibrin in pus gives rise to a

fairly satisfactory and rapid means of determining the presence of pus in milk. The milk threads catch and retain a large number of leukocytes in a mass. . . . If no fibrin is present, the leukocytes will be distributed singly or at most five or six gathered together. If any quantity of fibrin is present, large numbers of leukocytes, from twenty to one hundred in a single mass, will be seen under the microscope. . . . There can be little doubt that these leukocyte masses or clumps furnish the most practical and easiest means of determining the presence of pus and the healthfulness of milk." As to the number of leukocytes to be found when other conditions suggest the presence of pus, he says: "With these additional means of distinguishing pus, it is interesting to know about how many leukocytes are actually present when milk evidently contains pus. . . . Judging from these and other figures we have of a similar nature, it would appear that milk with a leukocyte count of 500,000 per cubic centimeter is suspicious, when it reaches 1,000,000 per cubic centimeter there is undoubtedly inflammation in the udder."

Therefore, in the light of our lack of knowledge of what should constitute a standard for pus, and in the presence of this statement of Doane's, it seems eminently unfair that anyone should publicly condemn the milk of any dairy for containing pus on the presence of 100,000 leukocytes per cubic centimeter. It is really incomprehensible that one can determine that a milk containing 96,800 leukocytes is free from pus and that a milk containing 100,000 leukocytes is a pus-containing milk.[3] It is interesting to note that in the 297 examinations for pus made by Stewart, in only one instance would any of these milks have been considered to have contained pus on the basis of Doane's figures.

The criticisms which Dr. Stewart makes in concluding his article are as follows: (1) One examination of milk per month is not sufficient; (2) examinations should be made more frequently in the summer than in the winter; (3) examinations for pus and streptococci should be made before the milk is sold; and (4) extra expenses connected with the examinations should be abolished at once.

Answering these in the order in which they were written, I would say that statement No. 1 is incorrect. The minimum number of examinations required by the Commission is one in each month. When there are indications that the working of the dairy or the condition of its products are unsatisfactory, additional examinations are made. The Commission fully recognizes the fact that more frequent examinations would be much more satisfactory to itself as well as to the consumer, but its purpose in making the examinations which may be held at any time during the month, as few as possible, is to reduce the expense to the producer. The only entirely satis-

[3] See Stewart's figures. AMER. JOUR. MED. SCI., loc. cit.

factory method would require a daily examination of the milk, and the expense of such examinations, which must be borne by someone, would scarcely be consented to by the producer and could not be borne by the Commission or the Society which it represents.

On the basis of the results obtained by Dr. Stewart, it is questionable if much more could be accomplished by having the examinations made with the same frequency as that adopted by him. Whilst he unquestionably detects failures more frequently than does the Commission, there are a number of instances in which with his frequent examinations he fails to note failures that are recognized by the Commission. The question is one which must be looked at from a practical standpoint and not from the theoretical viewpoint of a laboratory worker. It is an easy matter to sit in a laboratory and make a long series of examinations and evolve a theory therefrom that, if put into operation, might result in the elimination of bacteria in milk. Unfortunately, such theories are of no value. Whatever scheme is adopted for the improvement of the milk supply must take into consideration all of the difficulties under which the producer and dealer work, as well as the expense of the examinations. The purpose of any examination or any standard is to stimulate the producer to adopt the most modern equipment calculated to eliminate the objectionable features of milk production, and to establish a technique in its application as nearly perfect in all its details as is possible and to keep him constantly on the alert in carrying out the minute details of such technique. With the fact constantly before him that he has a definite standard by which his work is measured and that the test of his efficiency (the examination) is liable to be made on any day of the month, is, in the judgment of this Commission, a necessary and sufficient stimulus to good work.

The standard of 10,000 bacteria per cubic centimeter which is only a small part of the standard by which the Commission measures the work of the diary, we do not think, in the light of Dr. Stewart's results or those of our bacteriologist, too high. It is not expected by the Commission that this standard can always be maintained, nor can any useful standard which may be adopted, but we do know that during the most of the time it is, and that the effort on the part of the various producers to reach such a standard, results in the nearly constant production of a good safe milk—a milk so far above the ordinary market milks in point of cleanliness, constancy of its chemical constituents and freedom from pathogenic and all other forms of bacteria, that comparisons are impossible.

As to the necessity of more frequent examinations during the summer than during the winter months, the Commission is at variance with Dr. Stewart—a difference probably explained by the fact that Dr. Stewart made his examinations during two summers and one winter. In the experience of the Commission and in fact on the basis of Dr. Stewart's own figures, the percentage

of failures is greater during the months of February, March, and April than during those of June, July, and August, a fact which is probably attributable to the unpreparedness of the dairies for the sudden elevations of temperature which occur at these seasons and to the prevalence of high winds.

Even during these months the Commission does not see that any advantage is to be obtained by increasing the frequency of the examinations, because the examinations which are made detect the failures, and when failures are noted these dairies or their products are kept under supervision long enough to assure the Commission that proper precautions are being adopted to meet the conditions producing the unsatisfactory results.

The recommendation that milk should be examined for pus and streptococci before it is sold is so absurd that it scarcely deserves comment. What does such a proposition involve? In the first place, the milk from an entire herd is never all mixed together. The milk from certain sections of the herd only is mixed, and, therefore, in the product of each dairy there are a number of mixed milks.

If these different mixtures could be kept separate, it would be necessary to have samples from each examined, and even if one sample represented the milk from the entire herd, the inconvenience to the dealer and the expense of employing someone to make such examinations would be too great to place the scheme within the range of possibilities.

The only objection to Dr. Stewart's suggestion that "extra expenses connected with the examinations should be abolished at once," is that he does not suggest the means by which this can be accomplished. It has been the constant purpose of the Commission to reduce the expense to the producer to the lowest point possible, and any suggestion that tends to accomplish this will be gladly welcomed.

In order that the work of its experts—the veterinarian, the bacteriologist, and the chemist—might be of the utmost value, the Commission selected the most eminent men working in these lines to do this work. It is done at the present time at great inconvenience to all of them and at a figure that absolutely fails to compensate them for their services. They happen, all of them, to be men who are deeply interested in the purposes of this Commission, a fact which enabled us to secure their services, and the work that they have done has been most painstaking, conscientious, and valuable. To them more than to any other persons, the Commission owes the measure of success which it has met, and it desires to take this opportunity publicly to express to them its appreciation of their services.

The statement made by Dr. Stewart that "at present there is no one to whom the dairymen can go for either instruction or advice concerning methods, and when trouble comes and the milk is high in bacterial count, he does not know where to locate the trouble," is incorrect. The duty and the practice of the veterinarian is to

point out to the producer any deficiencies in his technique and to recommend measures for their correction. Any of the producers will testify to this. In fact one of the dairies and the Commission parted company because the owner objected to the criticisms and recommendations of the Veterinarian. The Commission has always aimed to be helpful to the producers—a statement which we believe will be endorsed by any of those to whose products we certify.

Dr. Stewart is also in error in his statement that most of the certified milk is "stored for twenty-four hours before it is delivered" and that the milk "delivered at the doors in the early morning hours" is usually two days old. None of the milks are stored for twenty-four hours and only part of the product of one dairy is forty-eight hours old when it reaches the consumer, but inasmuch as the product of this dairy—Dairy No III—makes the best showing bacteriologically of any of the milks which Dr. Stewart examined, this fact does not seem to have materially affected its quality.

The truth regarding the deliveries of the various dairies is this: The milk from Dairy I is twenty-four to thirty-six hours old when it reaches the consumer—not two days old, as Dr. Stewart says; the milk from Dairy III is thirty-six to forty-eight hours old; the milk from Dairy V is twenty-four to thirty-six hours old; and that from Dairy VI, twelve to twenty-four hours old. The Commission does not wish to be understood as commending the lateness of these deliveries and refers to the matter solely to correct Dr. Stewart's misstatements, which are unjust to the producer and dealer. The lateness of these deliveries is unfortunately necessitated by inadequate railroad facilities, a condition which the dealers of Philadelphia, as well as the shippers engaged exclusively in the dairy business, have endeavored unsuccessfully to overcome.

We accept with deep feelings of gratitude Dr. Stewart's statement that the Commission's "supervision of dairies has had a most excellent influence, an influence that is being felt in the general milk supply" and in this we believe he is correct, but again we cannot endorse his statement that "the bacterial counts of certified milk are rather disappointing." Our reports are better than his, but we are willing to submit his own figures in evidence.

In closing, the Commission wishes me to add a word regarding the pasteurized milk to which it certifies. At the time the Commission was organized little was known of the bacterial content of pasteurized milks. Pasteurized milks were considered safer than raw milks. The Commission assumed that if the milk which it examined in the raw state was safe from a bacteriological standpoint, it would be safe after pasteurization, and, therefore, decided to certify to it without examination, in order to reduce the cost to the producer. In the light of the examinations of Dr. Stewart and those of Drs. Evans, Pennington, and others, we find that we were mistaken, and we have decided to withdraw our certification of these milks in the future, at least our certification without examination.

REVIEWS.

ON PROFESSIONAL EDUCATION, WITH SPECIAL REFERENCE TO MEDICINE. By T. CLIFFORD ALLBUTT, M.A., M.D., F.R.S. London: Macmillan & Co., Lim., 1906.

WHATEVER else may be said of Dr. Allbutt, he cannot be accused of British insularity. He freely criticises the excessive conventionality of English public schools, their failure to encourage independent thought, and their tendency to encourage the English school-boy, during the plastic period of life, to shape his actions, pursuits, and mode of thought after what he calls "the monotonous pattern of Smith Major." He also touches on the question of athletics; not to disparage them for themselves, but to protest against the publicity of athletic sports, at least in secondary schools. While the subject of the address is chiefly the education of doctors, most of it is devoted to preparatory education in school and university. Facts are not the important things and are of no use until they are built into a theory. The world is moved by ideas, not by statistics; but for the purposes of mental discipline, scientific study is at least as effective as the so-called higher branches, history, the classics, pure philosophy, and ethics, and has the advantage that it can, and ought to be begun early.

Those who are unable to secure the advantages of a university training should devote the first two years of their five years' course chiefly to anatomy and physiology. These two subjects should be taught broadly, not for the purpose of imparting information only, but to train the student in accuracy of observation and logical deduction, and incidentally in the manual dexterity and resourcefulness which are essentials in the equipment of a practical doctor. Chemistry, while equally important, is too large and abstruse a subject to be treated in other than a practical manner as an aid to diagnosis, because the necessary time cannot be spared from the all-important subjects of anatomy and physiology and later of clinical medicine. In this connection and also in speaking of postgraduate work, Dr. Allbutt makes a strong appeal to the managing boards of hospitals for a greater liberality in opening their doors to students of medicine. "Every hospital, large or small, if its work is to thrive, and its patients are to reap the benefit, should be open to students. In teaching his pupil, the teacher educates himself—

reveals to himself his own latent capacities." In the later paragraphs of the address Dr. Allbutt gives a brief review of some of the great achievements of modern medicine and an optimistic forecast of its future, and devotes his closing remarks to a discussion of the practical side of the physician's life and certain general ethical questions. R. M. G.

PREVALENT DISEASES OF THE EYE. By SAMUEL THEOBALD, M.D., Clinical Professor of Ophthalmology and Otology in the Johns Hopkins University, Baltimore. Pp. 551. 219 illustrations and 10 colored plates. Philadelphia and London: W. B. Saunders Co., 1906.

THIS book has been prepared especially for the general practitioner. Its purpose is to acquaint him with all that can be known of ophthalmic practice without the ophthalmoscope, and without insistence upon the practical methods of measuring the optical conditions of the eye, or latent muscular anomalies; not that the author underestimates the importance of these fundamental conditions, for he is constantly and properly insisting upon them, and the imperative need of attending to them in the various diseased states in which they are a factor. What he wishes the reader to know, besides a general comprehension of what these errors are, and the signification of the terms describing them, is not necessarily how to correct them himself, but what conditions call for their correction.

With what success has the task been accomplished? There can be but one reply. The author has done so well that it is difficult to see how the book could be materially improved. The descriptions of such diseases as can be recognized by careful inspection, including oblique illumination, palpation, etc., are so clear that every medical reader should be enabled to profit by their perusal and apply the knowledge so gained to actual practice. Even of those diseases which require the use of the ophthalmoscope for their certain recognition (retina, choroid, optic nerve, etc.) the account is so lucid that the practitioner who is unacquainted with that instrument will be frequently enabled to form probable surmises, and will at least read with intelligence the report sent him by the specialist to whom he has referred the patient; for one of the main purposes of the author—in which he has admirably succeeded—is to teach the general practitioner which diseases of the eye he may treat himself and which require the services of a specialist.

But it would be a grave mistake to regard the book as of service to the general practitioner only. It will be found a useful standard of reference for the specialist as well. We surmise that it will

find its highest appreciation in the hands of those practitioners who, while not specialists, are paying particular attention to the eye and who have perhaps attended postgraduate courses upon that subject.

In a large work like this it would, of course, be strange if perfect unanimity of opinion should exist upon all of the numerous subjects treated therein. Like all who have strong convictions of their own, the author sets forth certain views more or less individual, such as a supposed "trophic" influence in the causation of certain severe forms of iritis, the use of very large probes in the treatment of stricture of the nasal duct (of which procedure he has long been an advocate), the effect of accommodative strain in causing a special form of choroiditis, "miliary" choroiditis, the existence of subnormal accommodative power, etc. We read with some surprise of the author's extreme preference for argyrol and protargol as against nitrate of silver in purulent conjunctivitis. We are under the impression that the organic salts of silver, the favorite of Darier, had failed in this country to sustain the reputation he had given them. Is it true that interstitial keratitis "occurs only as a result of inherited syphilis?" If our memory serves us right, Hutchinson himself made no such exclusive claim as to the luetic origin in all cases. To our greater surprise and some regret we read that the author is inclined to be somewhat vacillating upon the necessity of a cycloplegic in measuring the refraction in young subjects; he says: "the employment of a cycloplegic introduces (in many instances) as many x qualities as are eliminated through the suppression of the power of accommodation," etc. We should like to have the practitioners told that a cycloplegic is necessary in every patient under forty years, unless some decided contraindication is present—of which there is but a single real one, glaucoma or suspicion of glaucoma.

We cannot leave this important work without a tribute to its excellent style and clear English. There is not an obscure sentence in the book. We have no doubt that it will be productive of a great amount of good. We hope that it will serve as an incentive and model for specialists in other branches of medicine to place before the general practitioner as clearly as this does for the eye, what he can and should know of the different specialties.

T. B. S.

SYPHILOLOGY AND VENEREAL DISEASE. BY C. F. MARSHALL, M.D., M.Sc., F.R.C.S., Late Assistant Surgeon to the Hospital for Diseases of the Skin, Black Friars, London. New York: William Wood & Co., 1906.

THIS is a book of five hundred pages, octavo size, concisely written, original, and of interest alike to the physician and the

surgeon. It is not a text-book in the usual acceptation of this term, but is written with the view of stating tersely all that is known on the subject, backed by the author's personal experience. The topics covered, although in some instances briefly disposed of, are numerous and varied, syphilis being considered as it involes the skin, the circulatory, alimentary, respiratory, genitourinary, osseous, and nervous systems, as well as the eye and other special organs. It will thus be noted that the subject is handled in a systematic manner. In further confirmation of this observation reference may be made to the interesting chapters on the systematology of heredo-syphilis, heredo-syphilis of the nervous system, and syphilis of the third generation. All the matter pertaining to these topics is presented in such a concise and lucid manner as to command attention and impress the reader favorably. At the close of each chapter is a list of references to the works referred to in the text. While the book, as already stated, is not large, judged by the size of most books of the day on this or allied subjects, it is evident, nevertheless, that much thought, time, and study have been devoted to the diseases considered, and that the principal authors of the time, as Fournier, Finger, Neisser, Balzer, and Jadassohn, have been wisely consulted. Gonorrhœa, in the male and in the female, receive separate handling, being viewed from both a practical and a scientific standpoint, and in a style quite different from that usually met with in literature. That the author, in common now with most physicians, thoroughly appreciates the gravity of gonorrhœa in its consequences in the female is borne out by the statement that it is the cause of a large proportion of the diseases of women. Syphilis and gonorrhœa are regarded as probably the oldest diseases which have afflicted mankind; and syphilis is believed *par excellence* the hereditary disease, and may be transmitted to the third generation. A number of reasons are tabulated for regarding Spirochæta pallida (Schaudinn) as the pathogenic agent of syphilis, the only fact wanting to prove the pathogenic nature of this organism being the absence of cultures, all attempts at culture (up to the present time) having failed in the the case of spirochetes, spirilla, and trypanosomes. Spirochæta pallida is difficult to find, and cannot be shown in all cases. Metchnikoff failed to find it in 26 per cent. of the cases he examined. The reviewer had the opportunity of studying with Schaudinn some of his sections, and can bear testimony that often these organisms in a given specimen are few and far between. The various methods of treatment of syphilis are briefly but satisfactorily considered, the author expressing himself in favor of the use of metallic mercury, either in the form of pill, gray-oil injections, or inunction. There does not appear to be, according to the author, any advantage in using other preparations, except in cases which are refractory to metallic mercury. Iodides should be used during the course of treatment according as indications arise for mixed treatment.

The book as a whole may be commended for its simplicity and at the same time for its scientific and practical aspects. Its teachings are sound and progressive, and the subject is presented in an interesting and readable style. We bespeak for it a cordial reception by the profession. L. A. D.

THE DYNAMICS OF LIVING MATTER. By JACQUES LOEB. New York: The Columbia University Press, Macmillan & Co., agents, 1906.

THE whole biological world, a large proportion of the members of the medical profession, as well as others interested in natural science and, indeed, many of the laity throughout the world have become very familiar with the main features of some of Professor Loeb's most striking contributions to biology; but the present volume makes available for those interested in such matters all the main details of his own work, his personal studies being made the basis of a most fascinating discussion of the subject under consideration, and being joined together by numerous and interesting references to the work of others upon similar lines. One would have difficulty in finding a book containing a greater amount of suggestive thought and experiment. Indeed, to one that has been only partially familiar with the author's work, it is amazing to see the many evidences of brilliant thought and of fertility in experiment. He takes up first, in the series of lectures that constitute the book, the general chemistry of life phenomena, giving an exceedingly lucid brief discussion of the most conspicuous recent work on enzymes in their various relations to life. He then considers the physical constitution of living matter; referring, for example, to foam-structures and emulsions, to the colloidal character of living matter and its bearing upon biological problems, to surface-films, to osmotic pressure, to the antagonistic effects of salts, etc. His next lecture refers to the physical manifestations of life, discussing the physico-chemistry of muscular contraction, cell division, and the origin of radiant energy and of electrical phenomena, etc. Next he takes up the role of the electrolytes, and the effects of heat and radiant energy upon living matter; considers heliotropism, and other facts concerning tropisms and related phenomena; and finally discusses fertilization, heredity, and regenerative processes, including, in these latter chapters of the book, a discussion of his remarkable work upon artificial parthenogenesis and the artificial production of hybrids, together with many other points of intense interest. Like many another brilliant investigator, he looks at some questions from the standpoint that particularly interests himself, and occasionally does not give quite enough credit to the other side of the question. Such

enthusiasm, however, is often one of the most important factors in producing new knowledge; and it is unfortunate only so far as it occasionally leads the imperfectly instructed reader into too free an acceptance of some points that are still merely suggestive, rather than established. D. L. E.

A Text-book of the Diseases of the Ear, Nose, and Pharynx. By B. D. St. John Roosa, M.D., LL.D., and Beaman Douglass, M.D. New York: The Macmillan Co., 1905.

The most distinguishing features of this work are to be found in its thoroughness and completeness of scope, and in the common sense with which its authors deal with the problems of rhinology and otology. Both features are particularly noticeable in the portions of it which deal with the matter of treatment, and as methods of treatment are given more attention than any other aspects of their subjects, the authors are to be congratulated upon their achievement. Anatomy and pathology are but briefly dealt with compared with the amount of space allotted to the various measures calculated to give relief. We cannot but feel that this is a great advantage in a work of this character. So often such text-books are filled with lengthy descriptions of pathological appearances which are of but little value to the reader, and only serve to make the volume of greater bulk. Although a knowledge of the pathological conditions underlying diseases of the nose, throat, and ear is as absolutely essential to their proper treatment as it is to that of diseases elsewhere, nevertheless in a text-book commended for the use of students, or of practitioners, it is somewhat fruitless for the authors to exhibit their pathological knowledge to the exclusion of the practical deductions which they draw therefrom, and which are what the reader chiefly seeks in every book.

Every aurist of experience knows, or should know, that there is much that can be done to alleviate the sufferings of those who have chronic catarrhal ear troubles, and he also is unfortunately aware of the fact that much can be done to accelerate their progress by measures injudiciously directed toward their relief. We feel that Drs. Roosa and Douglass have struck a happy medium between advising too assiduous treatment and, on the other hand, encouraging as fully dangerous a neglect.

It is to be regretted that the illustrations are not of better quality; most of them are reproductions of old plates, and not at all the kind one expects in such an up-to-date book. As, however, so many of the modern books depend almost entirely upon the attractiveness of the illustrations, regardless of the value of the text, this feature may be passed over with slight regret. F. R. P.

OPERATIVE OTOLOGY—SURGICAL PATHOLOGY AND TREATMENT OF DISEASES OF THE EAR. By JOHN CLARENCE BLAKE, M.D., Professor of Otology in Harvard University, and HENRY OTTRIDGE REIK, M.D., Associate in Ophthalmology and Otology, Johns Hopkins University. New York and London: D. Appleton & Co., 1906.

IN the preface to this book the authors make the rather comprehensive claim that it is written for "the use of the student, the general and the special practitioner." After a careful reading we cannot but grant that they come very near, if not quite up to, the fulfilment of their promise. For the student the special value of this volume lies in the plainness with which it describes points in technique which are usually only learned by most beginners in otology after some hard experiences. The practitioner will find its pages exceedingly helpful in time of trouble, because of the fulness with which the authors deal with the many aural complaints which generally fall to the lot of the general practitioner, at any rate in their incipiency. To the specialist the value of the book will be found to consist in its up-to-dateness; all the freshest and newest subjects of interest in otology are here handled with a proper zeal qualified by a due discretion. An excellent section of the work is that devoted to "Adventitious Aural Surgery," in which the authors describe adenectomy, lumbar puncture, subcutaneous and intravenous injections. The descriptions of the various intratympanic and mastoid operations are excellent. There is no section of the work devoted especially to diseases of the Eustachian tube, and in fact that important *via dolorosa* receives but scant mention throughout the volume. The illustrations are especially commendable. Most of them have been made expressly for the book, and it is a pleasure to welcome a text-book on otology which is not filled with drawings purloined from Politzer and Gruber. F. R. P.

PHOTOSCOPY (SKIASCOPY OR RETINOSCOPY). By MARK D. STEVENSON, M.D., Ophthalmic Surgeon to the Akron City (Ohio) Hospital. Illustrated. Pp., 126. Philadelphia and London: W. B. Saunders Co., 1906.

THIS is a somewhat unequal book; many of the explanations of the theoretical portion are obscure; happily the practical directions for employing the test are in the main clear and precise. They should enable the practitioner who is conversant with ophthalmological methods to begin and carry to a successful issue the study of the practical application of the shadow test without an instructor. This we regard as no slight merit, and is the main reason why we

welcome the appearance of the work, since it will, no doubt, succeed to a greater or less extent in calling the attention of physicians, engaged in refraction, to the great value of skiascopy as the best practical objective test for the determination of the refraction of the eye.

There are naturally certain legitimate differences of opinion as to some of the injunctions prescribed, as when, in the estimation of astigmatism, preference is given to the measurement of each meridian by a sphere instead of by a combination of sphere and cylinder. This latter is, indeed, mentioned, but little is said of its special advantages for finding the true axis by the change in the direction of the band when the cylinder is wrongly placed. We also think that the reasons for working with the light close to the (plane) mirror admit of much stronger emphasis than is placed thereon by the author—surely the argument therefor is better than the preference each is inclined to give to his "own ophthalmoscope rather than any other." To paralyze the accommodation, homatropine hydrobromate is recommended in the strength of 4 grains to the ounce; thrice this strength is necessary to insure complete paralysis of the accommodation. The choice of the term anterior focal point for the point of reversal is unfortunate; the former term is applied to the most anterior of the cardinal points of the eye.

These lapses, however, as we believe them to be, are comparatively unimportant, where there is so much that is commendable. We have pointed them out with the hope that the author may subject all portions of his book to a careful revision when the time comes for another edition. We are so impressed with the value of the shadow test that we are anxious that everything connected therewith shall be presented clearly and free from blemish.

T. B. S.

CHIRURGIE OTO-RHINO-LARYNGOLOGIQUE. By GEORGES LAURENS, M.D., of Paris. 470 illustrations. Paris: G. Steinheil, 1906.

THIS large work in two volumes is one of a series of treatises on operative surgery published under the editorship of Profs. Berger and Hartmann. It may be regarded as a thoroughly modern exposition of the latest French views on the surgery of the ear, nose, and throat. We have rarely met with a clearer description of the complicated operations upon the ear than this work presents. This is not only true of the various operations in the mastoid region, but also of the intratympanic procedures. The sections devoted to intranasal and laryngeal operations are also excellent. The work is copiously illustrated with handsome plates, which are not only good artistically but really helpful in the elucidation of the text.

F. R. P.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Clinical History and Significance of Clubbed Fingers.—EBSTEIN (*Deut. Arch. f. klin. Med.*, 1907, lxvii, 89) gives a good review of the literature of clubbed fingers. He states that this our usual English term is a poor one and prefers the more accurately descriptive term used in Germany and France, "drumstick fingers." He thinks the term hippocratic fingers should not be applied to the condition, as Hippocrates described only the incurving of the nails and did not mention the characteristic thickening of the terminal phalangeal joints. Trousseau found thickening of the terminal phalanges, in a more or less marked degree, in nine-tenths of all subjects who had had definite signs of pulmonary tuberculosis for three months or over. In a large number of cases other than pulmonary tuberculosis, he observed the condition only twice, once in a girl with cardiac disease and once in an apparently healthy young man. Clubbing of the fingers is such a frequent occurrence in pulmonary tuberculosis that Trousseau says its presence has led to a diagnosis of the disease when other physical signs were equivocal. Later observers point out how frequently clubbing occurs in other conditions and Blandin summarizes as follows: We know that curvature of the nails occurs not only in phthisis, but in all chronic conditions associated with wasting. Heller, too, emphasizes the little diagnostic and prognostic significance attaching to clubbing of the fingers. In bronchiectasis the condition is particularly well-marked and the fingers are, as a rule, shorter and broader than in phthisis. The nails frequently show an ulnar deviation. The clubbing of the fingers comes in some cases with great rapidity, and Bamberger states that it has been noticed to develop from the time the previously

odorless sputum becomes fetid. Gerhardt considers clubbing the earliest stage in a series of rheumatoid affections of the joints, common in bronchiectasis, and of the bone changes described by Marie. Clubbing also frequently follows empyema. Dening reports a unique instance of the development of typical clubbed fingers in a case of gastric dilatation followed by pyloric stricture from a healed ulcer. After operation the clubbed fingers returned to their normal condition. The French authors particularly call attention to the association of clubbed fingers and hepatic cirrhosis. The condition is most marked in the cirrhoses of children. Gilbert and Lerchoullet have collected 40 instances. In the cases of autotoxic enterogenous cyanosis described by Stokvis and v. d. Berg, clubbed fingers is one of the characteristic symptoms. The relation of the changes in the fingers to the pulmonary osteoarthropathy of Marie, or, as Sternberg more correctly terms it, toxic osteoperiostitis ossificans, has given rise to much discussion; 75 per cent. of the cases of osteoperiostitis occur in association with pulmonary lesions—tuberculosis, bronchiectasis, and other purulent affections of the lungs and pleura, and it is generally conceded that clubbing of the fingers represents the first stage of the condition. In myxœdema and pulmonary tumors clubbed fingers occasionally occur, and Swoboda has recently called attention to their frequent presence in rachitic children with deformities of the chest causing restriction of respiratory movements. Next to disease of the lungs clubbing of the fingers is most common in cardiac lesions; unusual in acquired, but very frequent in congenital disease. It occurs particularly often in pulmonary stenosis and in defects of the septum. Of great interest are the cases of clubbing restricted to one hand. The condition is unusual, and in the few reported instances has always been associated with thoracic aneurysm. Shrinkage of the sac has been followed, in some cases, by disappearance of the clubbing. The pathology and etiology of the condition is not well understood; Ebstein gives at some length the various views prevailing.

Erythema Exudativum Multiforme and Nodosum of the Mucous Membranes and Their Relation to Syphilis.—Trautmann (*Münch. med. Woch.*, 1906, liii, 2101) calls attention to the importance of making an accurate differential diagnosis between syphilitic and erythema multiforme and drug eruptions of the mucous membranes of the mouth and upper air passages. In 39 cases of erythema multiforme he found a lesion of the mucous membrane in 20 cases, a mucous membrane eruption subsequent to the skin eruption in 4 cases, a primary mucous membrane eruption with subsequent skin lesion in 11 cases; a solitary mucous membrane eruption in 4 cases. Many of these occurred in patients who had previously had syphilis, and had been subjected to repeated and heroic mercurial treatment without benefit and, indeed, often with a good deal of harm. The erythematous lesions in the mouth undergo maceration and destruction and come to resemble very closely specific lesions; the deception is particularly imposing when there is an associated papular erythema of the skin or the nodes of erythema nodosum along the tibia. In the latter instance the diagnosis is especially difficult, as Hoffmann and Mauriac have described a syphilitic form of erythema nodosum which is clinically hardly distinguishable from it.

Trautmann believes that any non-specific erythema multiforme may occur synchronously with true syphilitic lesions of the skin, and the two must not be referred to a common cause. The curious herpetic eruption described by Fournier, the herpes recidivant Fournier, is preceded in 96 per cent. of the cases by syphilis. Trautmann considers the syphilis, however, merely a predisposing agent, just as tuberculosis so very frequently occurs in diabetes. Mucous membrane eruptions due to mercury are not uncommon. They occur usually in an area between the base of the tongue and the larynx. They are, of course, aggravated by pushing antisyphilitic treatment. The 7 cases Trautmann reports are interesting and important. In all there were lesions of the mouth or larynx in patients giving a history of previous lues; all had stubbornly resisted antisyphilitic treatment; all responded favorably to salicylates.

The Roentgen-ray Diagnosis of Unusual Heart Lesions.—DENEKE (*Deut. Arch. f. klin. Med.*, 1907, lxvii, 39) reports two cases in which a study of the heart shadow was of importance in diagnosis. The position, form, and size of the heart have been very carefully studied, but Deneke thinks too little attention has been paid to the intrinsic movements. In his first case, an instance of Stokes-Adams' syndrome, the partial heart block could be beautifully demonstrated by watching the movements of the auricles and ventricles. In a case of congenital heart disease a probable diagnosis of transposition of the large vessels and a defect in the interventricular septum was made, and the assumption was verified by autopsy. Fluoroscopic examination aided greatly in arriving at this conclusion. Normally the right border of the cardiac shadow is formed by the right auricle, and this portion of the heart makes only faint fluttering contractions, while the left border formed by the left ventricle is seen to contract forcibly. In the reported instance both borders contracted synchronously and forcibly and the whole heart was drawn together with the strong, sustained impulse. Evidently, there was a greatly hypertrophied right ventricle pushing the auricle upward or backward. As pulmonary stenosis and patent ductus Botalli could be excluded by other physical signs, a defect in the interventricular septum was diagnosticated.

Fever.—BEITZKE (*Berl. klin. Woch.*, 1907, xxxiii, 110) reviews the recent contributions to the pathology of fever and summarizes the present state of our knowledge. He points out that a definition of fever is itself very difficult and no two authors exactly agree. It is hard to distinguish which are the manifestations of the fever, which of the infection. All varieties of fever have in common an increased body temperature and an increased metabolism, the other manifestations being partly due to this, and partly independent of the fever. The increase of body temperature depends upon an increased heat production and a decreased dissipation. In a normal person these two factors are so nicely adjusted that even under extreme circumstances, such as excessive heat production with muscular exertion and great variations in the external temperature, the body temperature remains unchanged. This balance is broken in fever, but the two factors are varyingly disturbed. During the rise of temperature heat production is particularly

increased, often more than at the height of the fever, especially if there is a chill. Heat dissipation is usually decreased, but often remains unchanged, and at times is even increased. During the height of the fever production and dissipation are both increased; the latter, in many cases, over 50 per cent. But they bear no direct ratio to one another, and, as a rule, run as separate curves more or less widely separated. The percentage of heat dissipation by retention, conduction, and evaporation retains usually a normal relation, while during muscular exertion 78 per cent. of the loss occurs by evaporation. In fever with great emaciation, production and dissipation both sink, production being often very low, but fever still persists because dissipation remains below it. As the temperature falls production always falls, but dissipation shows a varying dissipation. During a crisis it comes down rapidly, during lysis very slowly. It may even be subnormal, and the two curves of production and dissipation slowly approach one another.

The origin of the increased heat production is the heightened metabolism. It is true that the temperature itself may be responsible for a part of this increase, but the metabolism of fever is far greater than that caused by simple overheating and, as a rule, it begins before the onset of the fever. The relation of the carbonic acid secretion to the oxygen inhaled and of the carbon excretion to the nitrogen intake remain normal unless there is great emaciation. The increased metabolism affects principally the albuminous substances, the nitrogen excretion increasing from 50 to 150 per cent. The albumin is usually burnt to its end product, urea, but earlier stages of the oxidation often appear in the urine. Qualitatively the reduction reactions are probably the same as in health. It is difficult to ascertain the degree to which carbohydrates participate in the increased metabolism. It has been shown that carbohydrates may be derived from albumin, and some authors see in them the source of energy of albumins. At least all existing carbohydrates are rapidly burned. Fat is consumed to no greater extent than in any condition of inanition. In all fevers there is a marked retention of water and of inorganic salts, particularly of chlorides.

The place where the increased metabolism principally occurs is disputed. Krehl, Rolly, and others designate the liver; Senator, Richter, and Aronsohn the muscles. The reasons in favor of the latter view are, in health three-fourths, in fever two-thirds, of the carbonic acid is formed in the muscles. In fever the temperature in the muscles rises from 3.76 to 4.48°; in the liver only from 2.3° to 2.88°. In fever the urine is rich in creatin and other products of muscle metabolism. The increased activity of the heart and respiratory muscles alone accounts for one-twentieth of the whole heat production.

Most fevers are caused by the circulation of free toxins either of bacterial or inorganic origin or by the absorption of organic poisons from abscesses or blood clots. Krehl believes these may act by directly stimulating metabolism. In other instances, however, fever follows cerebral compression, and in these cases a direct influence upon the heat-regulating centre must be assumed. Aronsohn and Sachs were the first to produce fever by irritation of the corpus striatum. They do not believe in a direct albumin disintegration by the toxins and they think that all fevers are due to changes in the nervous system affecting

the heat regulating centre. That fever is the expression of a beneficial reaction of the body is gaining ground. Of itself it could be harmful only if it arose to a very high degree, when the same dangers are to be feared as in insulation. Such an occurrence is rare. The same is true of the increased metabolism which becomes a danger only when there is great inanition. Every physician knows what a bad prognostic sign little or no fever is in severe septic or typhoid infections. Similarly a fall of temperature after artificial animal inoculations is a bad omen. By high temperatures bacteria and their products are partly destroyed, partly rendered harmless. The reaction between toxin and antitoxin takes place better at an elevated temperature.

Muscular Cirrhosis of the Lungs.—DAVIDSOHN (*Berl. klin. Woch.*, 1907, xliv, 33) bases his paper on an autopsy on a man who died of septic endocarditis. The man is said to have suffered for some time with some variety of pulmonary inflammation. The lower lobe of the left lung was so fleshy in appearance that the term carnification was the only one that would fit the microscopic description. That this carnification was due to the presence of smooth muscle fibers was first suggested by the brown appearance of the cells in Van Gieson's stain. The fibers were gathered in bundles running in all directions and without special arrangement, resembling very much a uterine myoma. The pleura covering the lobe was changed into a thick fibroid mass without any muscle cells. The first mention of this pathological condition is by Buhl, in 1873, his description corresponding closely to that of Davidsohn, and its rarity is apparent from the statement of Orth that he himself has never seen an instance. There is now abundant evidence to prove the existence of smooth muscle fibers in normal lung tissue, and Orth notes that they may be much increased in number in brown atrophy. There is nothing in favor of assuming a metaplastic transformation of the connective-tissue cells into smooth muscle fibers. The possibility of the condition being a metastatic myoma or an angiomyoma arising from the vessel walls must be considered. Against the first may be urged that the process is diffuse and not at all like a tumor, and the entire absence of large numbers of lumina of bloodvessels excludes the second. The striking resemblance to the latter condition noted at first glance is shown to depend upon the presence of numerous collapsed alveoli. It seems most probable that the muscle fibers arise by the division and proliferation of preëxisting cells. Davidsohn suggests that the term carnification be reserved for these unusual instances of smooth muscle overgrowth.

Eosinophilic Intestinal Disease.—NEUBAUER and STAUBLI (*Münch. med. Woch.*, 1906, liii, 2380). The occurrence of eosinophiles in certain inflammations of the mucous membranes is accompanied by the formation of Charcot-Leyden crystals and frequently by an increase of eosinophiles in the blood. Evidence points to the Charcot-Leyden crystals arising from the eosinophile cells, and their occurrence has the same significance as finding eosinophile cells. The increase of eosinophiles in the blood is not a constant feature and in some instances they may be diminished in number or even absent. The occurrence of Charcot-Leyden crystals in the stools was first observed in ankylostomiasis and

later in other intestinal parasitic infections. Eosinophiles rapidly disintegrate in the bowel, and although they may be missed in the stools there is often an increased number in the blood. This occurrence of eosinophilia with intestinal parasites is so striking that Lichtenstirn has considered them pathognomonic. But later authors have found them to occur in other conditions. Neubauer and Stäubli report cases of acute diarrhœa with marked constitutional symptoms, finding in the stools of the first Charcot-Leyden crystals, and in the second, eosinophiles. During the height of the attack the eosinophile cells had completely disappeared from the blood, returning with abatement of the symptoms. Analogously, the absence of eosinophiles in the blood has been noted in the acute stage of bronchial asthma, and it has been suggested that the supply is drained by the sudden local demand. Dock has shown that eosinophiles may be present in the stools of patients with amœbic dysentery. In the third case reported by the author, one of acute dysentery, they were likewise found, although amœbæ were absent and no typical dysentery bacilli could be cultivated. In the last three cases reported an interesting affection of the lower bowel is considered, which the authors believe is distinctive enough to be classed as a separate clinical entity. All are remarkably similar, occurring in young adults with symptoms of severe diarrhœa and discharges of blood and mucus. Charcot-Leyden crystals were found in the stools of all and numerous well-preserved eosinophile cells in two. Intestinal parasites as well as specific bacteria (dysentery bacilli, tubercle bacilli, gonococci) were absent. The rectal examination through the proctoscope showed an intensely red, loose, mucous membrane with numerous small, yellowish-white areas of exudate which could be easily scraped off and under the microscope were seen to be made up of eosinophile cells and granules and Charcot-Leyden crystals. After scraping off the exudate a deeply injected bleeding erosion remained. There were no ulcers and no cicatrices. Two of the cases showed a distinct increase of the eosinophiles in the blood. Helber, in 1905, described a disease similar to this as sigmoiditis chronica granulosa, but as he says nothing about eosinophiles, the two conditions cannot be definitely identified as the same.

SURGERY.

UNDER THE CHARGE OF

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A Contribution to the Study and the Treatment of Impassable Noncancerous Strictures of the Œsophagus.—Gross and Sencert (*Revue de chir.*, 1907, xxvii, 1) say that when one has failed, after repeated

and careful attempts, to pass through a stricture from above downward, an examination by the œsophagoscope is necessary. Often the stricture will thus be rendered passable, by exposing its upper orifice to the view of the surgeon. Only exceptionally will this method fail. Eccentricity of this orifice is the chief obstacle to blind catheterization. Once the dilatation has been begun it can be carried out without the aid of the œsophagoscope. When a very old and resisting stricture cannot be overcome by progressive dilatation, a metal instrument of the same caliber as the fine dilating bougie should be passed. A thread is tied to its upper end and brought out of the mouth. The instrument is left in place with little or no disturbance to the patient, and is withdrawn by simple traction after twenty-four hours. Ordinary dilatation may then be carried on, or a metal instrument of larger caliber may be introduced by the aid of the œsophagoscope, or this may be continued with instruments of larger caliber until the normal caliber of the œsophagus is obtained.

If the examination by the œsophagoscope reveals a diverticulum or prestrictural pouch, with more or less inflamed and fragile mucosa, threatening postoperative dangers, the method of treating the stricture should be changed. Two varieties of cases present themselves: those in which a gastrotomy has already been performed, and those in which it has not. If a fistula exists, retrograde catheterization may be tried, and if one has the good fortune to pass the cardiac end of the œsophagus, he can practise dilatation immediately, without recourse to the method of von Hacker. Unfortunately this will often be impossible.

When there is no gastric fistula, Delagénière has employed a large gastrotomy in order to pass the cardia and the stricture with a sound. Dilatation by von Hacker's method is then carried out. Gross and Sencert say that this operation exposes the patient to considerable danger from peritonitis and to the possibility of failure to pass the stricture with the dilating instrument. A permanent gastric fistula is then the only salvation of the patient. In such cases the authors propose an operation which they have studied on the cadaver. A median laparotomy above the umbilicus is performed; the stomach is exposed and seized at a point on the anterior surface, about 2 cm. below the cardia. A purse-string suture passed through the external coats of the stomach without going through the mucosa is made to circumscribe here an area 1.5 cm. by 2 cm. in diameter, the ends of the suture being left untied. An opening is made in this area into the stomach and an œsophagoscope introduced, when the purse-string suture is tightened about the tube, preventing the soiling of the peritoneum with stomach contents. The tube being cleansed, the cardia is sought and with care the lower end of the stricture is found. Simple retrograde dilatation is then carried out with the aid of the œsophagoscope. The Gross and Sencert feel certain that this method of retrograde catheterization is a better means of finding the lower end of the stricture than the large gastrotomy of Delagénière. If all these methods fail, then the major operations—external œsophagotomy, œsophagectomy, œsophagogastrotomy—may be considered, but only after repeated failure by all the preceding methods.

The Appendicitis Question.—HAIM (*Zentralb. f. Chir.*, 1907, xxxiv, 33) made a bacteriological examination in cases of streptococcic appendicitis, the results of which he discusses briefly and with caution as to their general reliability. He hopes that they will encourage the collection of statistics of the appendicitis cases operated on in the acute stage, from which we may settle many questions arising concerning them, and obtain a clearer conception of their nature. From his observations he concludes that the severe, diffuse, streptococcic cases occur most frequently in the spring, in the months of March and April, and in the fall months of October and November, and that they are very rare at other times. Again, certain symptoms are more common in certain groups, as cases with herpes, or with icterus, etc. The colon bacillus, which produces a milder form, seems to be equally active throughout the year. The etiology seems to vary in different countries, in the northern countries the bacillus coli and the pneumococcus prevailing; and in Germany, France, and probably in America, the bacillus coli and streptococcus; while in Italy and England usually the bacillus coli. This may explain the great difference in mortality of different authors. The streptococcic cases occur by preference in children and adolescents, the milder forms in older people. The prognosis in streptococcic cases is better in the young than in the old, in whom they are almost always fatal. The prognosis is, of course, dependent also on the time of operation: the earlier the operation the better the prognosis. The intermediate stage here offers no advantage, so that no delay in operating should be advised. The diagnosis can be made only by the symptoms. Greater material placed at our disposal will probably support these observations and develop new points. In all cases the bacteriological examination should involve the contents of the appendix and the resulting exudate.

Three Cases of Tumor of the Bladder without Hematuria.—GUIZY (*Annales des maladies des organes genito-urinaires*, 1907, xxv, 103) reports one case in a married woman, aged fifty years, without children, who suffered from very frequent urination, cloudy urine, and at times complete retention. The cystoscope revealed an enormous papillomatous tumor with three long prolongations, occupying a large part of the superior zone of the anterior wall. There was no hematuria whatever. By a suprapubic cystotomy he removed the tumor, which occupied the greater part of the cavity of the bladder. Two years later, the patient remained completely cured.

In the second case—a married man, aged fifty-eight years, suffering from frequent and painful micturition—the cystoscope revealed a tumor with a large pedicle, occupying the mediosuperior zone of the anterior bladder wall. The urine was cloudy and ammoniacal, with a few very fine sanguinolent filaments. The patient never had hematuria, not even a drop of blood. Nothing abnormal could be determined in the renal regions, but the liver was enlarged, irregular, indurated, and painful. Death occurred after some weeks, with a carcinomatous cachexia.

The third case was in a woman, aged forty-one years, without children, who suffered from frequent and painful micturition. The exploring sound developed an extreme sensitiveness of the vesical mucosa. The cystoscope showed a papillomatous tumor, which was removed by a

suprapubic cystotomy and found to have a very large and short pedicle, attached to the superior part of the anterior wall of the bladder. There was no hematuria. The question arises as to whether the attachment of all three of these tumors to the anterior wall of the bladder explains the absence of hematuria.

Tennis Elbow.—PREISER (*Zentralbl. f. Chir.*, 1907, xxxiv, 65) says that there is a characteristic injury resulting from tennis playing, just as we have a fracture of the radius in chauffeurs and a fracture of the malleolus in foot-ball players. The tennis injury has already been referred to by Clado, who considered that it is due to a rupture of some of the fibers of the supinator brevis muscle. Bähr, in reporting two cases, says that the injury was traceable to a forcible movement of the forearm in pronation, and that the head of the radius was very painful to pressure He thought that the degree of pain suggested a periostitis, but that there might be rupture of a ligament.

Preiser has observed two cases which convinced him that the condition was not the result of a tearing of the supinator brevis fibers. His patients were strongly built men, who during the tennis season developed gradually a pain in the right elbow. Finally tennis playing became a punishment and complete extension impossible. Effusion in the elbow could be recognized. By pressure of the finger during pronation and supination, as well as in tennis playing, the pain was especially localized to the palmar surface of the forearm. Flexion became painful and limited toward its completion, and extension was possible only to an angle of 160 or 165 degrees before it became painful. Passive extension was complete with pain, but movement between the painful limits was free and free of pain. The *x*-rays showed no fracture, while the effusion in the joint indicated, according to the author a process in the joint capsule.

Preiser explains the localization of the injury by the origins of the supinator brevis and brachialis internus muscles. Each has a part of its origin from this portion of the annular ligament, the latter muscle being a strong flexor and pulling upward on this part of the capsule. The supinator brevis pulls in the opposite direction, that is, downward. The result of long-continued violent contraction of these muscles would be to produce a gradually increasing chronic inflammation at this part of the capsule. Those parts of the play necessitating strong flexion and supination are evidently responsible for the lesion. The condition yields stubbornly to treatment. The first indication is to forbid tennis playing. Massage, especially friction of the infiltrated capsule, brings greatest relief. Bathing of the elbow twice daily in hot water should be ordered.

Plastic Repair of the Peritoneum with Isolated Omentum.—GIRGOLAFF *Zentralbl. f. Chir.*, 1907, xxxiv, 113) in this contribution answers the criticisms of Springer, who compared Girgolaff's experimental results with his own and found Girgolaff's conclusions too sweeping. According to Springer's experiments, extensive peritoneal adhesions occur, and absolute protection against perforation of the intestine does not occur, if the insecure sutures are covered with an isolated portion of the omentum. Against the first statement of Springer, Girgolaff can only refer to the

results of his own work on the stomach, large intestine, and bladder, where no adhesions resulted. He says that an absolutely sure preventive against adhesions does not exist. In his work on the small intestines he found that when special efforts were made to obtain thorough asepsis and hemostasis the adhesions were very few and unimportant, but if an inflammatory infiltration or a considerable hemorrhage occurred, then the resulting adhesions were considerable. Girgolaff did not see any long bands which might have led to strangulation. It is noteworthy that when wounds of the upper and anterior surface of the liver were covered with pieces of omentum no adhesions developed, but they did occur on the under surface where the blood accumulated. Tuffier has employed isolated omentum to cover a wound of the liver, and Lebreton to cover a wound of the spleen both with advantage. To cover the proximal stump of the omentum, as in hernia operations, is always of value. Girgolaff has never seen adhesions develop from this. In regard to the effectiveness of the closure of a perforation by an isolated piece of omentum, Girgolaff refers to his own and Sundholm's results, and says that after making a permanent opening in the intestine, by suturing the mucosa to the peritoneum, he closed this opening by covering it with isolated omentum, and in no case did peritonitis result. If the omentum is rich in fat, the excess can be removed by scissors, thus increasing its ability to form adhesions.

Surgery of the Hand.—Van Hassel (*Annales de la Société Belge*, 1907, vii, 19) says that the recent law on the accidents of workingmen has made the surgery of the hand of much importance, because of the importance of this member to the laboring man. At the last meeting of the Surgical Society, Gyselynck and Lemoine presented a remarkable paper on this subject. In burns the writer has obtained his best results by irrigations and dressings with artificial serum. Burns of the third degree, however, require careful watching to prevent troublesome deformities from contraction, and when these do occur they require autoplastic operations. Punctured wounds are more troublesome than incised, because of the danger of deep infection and lymphangitis. When there are foreign bodies in the wound, Van Hassel employs cupping and the Bier bandage. In contused wounds, after thorough irrigation with bichloride solution, he proceeds immediately to bring together, as carefully as possible, all the divided tissues, torn periosteum, tendons, cellular tissues, in different planes, draining as well as the conditions will permit. In this way he tries to overcome the adhesion of the skin to the deeper layers by scar tissue. He immerses the part daily in the physiological serum, and irrigates freely with boric-acid solution. With this method he has been able to obtain a perfectly useful hand in cases in which, at the time of the accident, it seemed that amputation was necessary.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Pharmacology of Digalen.—J. B. RENEAU (*Revue thérapeutique*, 1906, lxxiii, 721) concludes a study of the pharmacology of digalen (soluble digitoxin) with the following statement: If digalen, from a chemical point of view, does not appear to be a definite substance and one differing from the other active principles derived from digitalis, its manner of action upon the organism, its toxicity, and its local effect would lead one to consider it a substance nearly kin to digitalin, possessing similar cardiotonic and vasoconstrictor properties which are susceptible of interesting therapeutic utilization by reason of its feeble toxic action, of its lack of cumulative effect, and its weakly irritant local action.

Ovarian Extract in the Obstinate Vomiting of Pregnancy.—G. STELLA (*La semaine médicale*, 1906, xxvi, 523) believes that ovarian opotherapy possesses a true field of usefulness in the hyperemesis of pregnancy. The patients who he has treated by this means have been immediately relieved of this troublesome symptom, and his results have been so striking that he states that this form of treatment should always be tried before the advisability of emptying the uterus is considered. The dose prescribed corresponds to 45 grains of the fresh gland; in the most severe instances of vomiting this quantity may be progressively increased to twice this amount.

The Pharmacology of Veratrum.—WOOD, JR. (*Jour. Amer. Med. Assoc.*, 1906, xlvii, 2061), draws the following conclusions from experimentation with this drug: (1) Neither veratrin nor rubijervin is present in veratrum viride root in sufficient amount to be held responsible in any degree for the activity of the drug. (2) Protoveratrin, although an extremely poisonous substance, differs essentially in its effects from the veratrum rhizome, and, therefore, is not to be considered its active principle. Moreover, the proportions of it are too small to permit of its being considered the toxic ingredient. (3) Of the known proximate principles, jervin most nearly corresponds in its physiological action to the crude drug, but is present in too small amount in proportion to its toxicity to be considered the chief active ingredient. (4) The evidence, therefore, seems to be conclusive that there is in veratum viride some active substance as yet undiscovered.

The Preventive Treatment of Serum Disease.—W. D'ESTE EMERY (*The Practitioner*, 1906, lxxvii, 754) discusses the prophylaxis of this condition, which is due to the injection of antitoxic sera and is characterized by fever, a rash of variant type, lymph-gland enlargements, and other symptoms. He says that Netter's preventive treatment, which consists in the administration of calcium chloride, is a decided therapeutic advance. The drug is administered in doses of 15 grains at the time of each injection and for two days subsequently. Among 114 cases treated thus, Netter observed 11 mild instances of serum disease, whereas in a control series of equal number the condition developed twenty times. These results are readily credible in view of the well-known fact, first shown by Wright, that many cases of urticaria are associated with a deficient power of coagulation of the blood and a diminished calcium content, and are curable by calcium chloride or lactate. Why the injection of serum should cause such alterations in the blood and what is the reason for the delay in the appearance of the symptoms are facts less clearly understood; possibly the formation of the precipitins, or of the precipitates they cause, may remove some of the calcium from the blood. If this is the case the serum disease might develop in a few patients only, that is, in those with a deficient calcium content in the blood.

Irrigations with Pulp of Pigs' Liver in Hepatic Cirrhosis and Tuberculous Peritonitis.—DESPLATS (*Jour. de sci. med. de Lille*, 1906, No. 30, p. 73) reports an instance of tuberculous peritonitis and cirrhosis of the liver, which when first seen presented general anasarca, dyspnœa, albuminuria, and hematuria. After being supervised for four months, during which time tapping was often necessary, irrigations of 10 ounces of a pulp made from pigs' liver were prescribed. In less than two months there was marked improvement, the hematuria was less, tapping was no longer necessary, and the masses in the peritoneum had decreased in size. The patient continued to improve rapidly and returned to work. Desplats reports a second similar instance in which just as remarkable a cure was attained.

The Treatment of Tuberculous Meningitis.—G. REABOLD (*Münch. med. Woch.*, 1906, No. 35, p. 1709) advocates treatment by repeated lumbar punctures and the withdrawal of the cerebrospinal fluid. He reports a cure in a patient in whom bacteriological tests confirmed the diagnosis and in whom the operation was performed twenty-four times with the withdrawal of a total quantity of 574 c.c. of fluid. In his opinion the results of the treatment are most striking. It is followed by an almost immediate amelioration of the patient's condition, which is rendered progressive by means of daily withdrawal of fluid and the consequent relief of intraventricular pressure. It should not be forgotten that the fluid is likely to re-accumulate rapidly. In determining the indications for puncture the subjective condition of the patient and the evidences of intracerebral pressure, as manifested by headache, etc., should be taken into consideration. When the febrile movement disappears and the albumin content of the cerebrospinal fluid becomes diminished, the intervals between the punctures may be lessened.

Tuberculin Treatment.—SAHLI (*Correspondb. f. Schweizer Aerzte*, 1906, Nos. 12 and 13, pp. 373, 417) states that, in his opinion, this form of treatment is, when the proper dosage is not exceeded, entirely harmless. All reaction should be avoided. In favorable instances the general condition becomes improved and the cough and physical signs are diminished. If fever is present the tuberculin treatment is contraindicated, since here, in Sahli's opinion, the system is already saturated with tuberculin. He also considers that mixed infections are unusual and that failures in treatment should rarely be attributed to this cause. He employs Beraneck's tuberculin, the dosage of which should be varied in accordance with the susceptibility of the patient. The usual number of injections is two per week.

Sodium Citrate in the Dyspepsia of Adults.—L. LACHENY (*La semaine médicale*, 1906, xxvi, p. 536) has, after numerous experiments, shown that this substance is potent in certain gastric disorders. He prescribes it in 10 per cent. aqueous solution, of which the dose is a dessertspoonful. This quantity is taken every five minutes until the gastric pain or nausea, which some patients so frequently exhibit after eating, has disappeared. He has achieved excellent results in a considerable number of patients by this means of treatment. In the most favorable instances, at least 15 grains of the citrate are necessary to relieve the symptoms, and resistant patients may be forced to take seven or eight times this amount to obtain relief. Cure, at least temporary, of the symptoms is usual, and if there is a recurrence the treatment may be repeated.

The Medical Treatment of Malignant Disease of the Stomach.—EINHORN (*The Postgraduate*, 1906, xxi, 1192) suggests that it is always wise to try antisyphilitic treatment in instances of gastric tumor, even though all symptoms point to the probable malignant nature of the growth, for although failure may occur in 95 per cent. of the patients, much will be accomplished if the other 5 per cent. are saved. In the management of true cancerous disease Einhorn considers it a mistake to inform the patient of the nature of his complaint; sedatives to relieve the pain are advised. Diet is an important question, and if the growth does not cause so marked a stenosis as to prevent the passage of fluids, a strictly liquid diet is to be prescribed, consisting of eggs beaten in milk or bouillon, oyster broth, calf's foot jelly, etc. Two or three quarts of milk daily will cause an increase in the patient's weight. If there is no stenosis a semisolid diet is advisable, consisting of farina with milk, pea-soup, etc. With pyloric obstruction operation should be advised. With regard to medicines fluidextract of condurango bark should be mentioned; it improves the appetite and is an excellent stomachic. Hydrated chloral acts as a sedative and prevents fermentation; it may be given in 3 per cent. solution, a tablespoonful three or four times daily Methylthionine hydrochloride seems to prolong life in some instances and may be of benefit. It certainly can do no harm. Gastric lavage is useful if fermentation of the gastric contents is present. He considers the employment of the *x*-rays to be of little use. Radium, locally applied, especially in malignant stricture of the œsophagus and in cancer of the stomach, has a decidedly beneficial effect.

Œsophageal Stricture Treated by Injections of Fibrolysin.—WEISSELBERG (*Münch. med. Woch.*, 1906, No. 33, p. 1623) reports an instance of stricture of the œsophagus following ingestion of a caustic. Following twenty injections of fibrolysin into the skin of the back, at two to three day intervals, the upper stricture permitted the passage of a good-sized sound. A second contraction was, however, demonstrated at the cardia; this would not allow the passage of the finest instruments. After thirty-nine injections this became patent to a small sound and finally complete cure was attained. No evil effects other than slight local pain, and on two occasions small abscesses, followed the injections.

Creosote Irrigations in Dysentery.—G. ZANARDINI (*La semaine médicale*, 1906, xxvi, 462) has treated successfully eleven instances of dysentery by irrigations of an emulsion of creosote prepared by adding to a quart of water, with which the yolk of an egg has been mixed, a dram of 10 per cent. creosote. BILLET has also employed creosote irrigations in dysentery due to the Entamœba hystolytica of Schaudinn. He gives irrigations of from one pint to one quart of 1 to 2 per cent. creosote, which has been previously mixed with oil of sweet almonds, in water. Usually two enemas a day are prescribed. In a large majority of the patients thus treated, the pain is rapidly relieved and the blood and the fœtor disappear from the stools.

Vegetable Iron; the Therapeutic Employment of Rumex Crispus.—GILBERT and LEREBOULLET (*Les nouveaux remèdes*, 1906, xxii, 361) state that iron exists in plants in loose combination and in masked form. The former can be easily dissociated by the usual reagents, but the latter is resistant to these. Practically the therapeutic utilization of iron in masked combination is difficult on account of the small quantity which most vegetable substances contain. Amongst these Rumex crispus is an exception and is able to render to the organism a considerable amount of iron, if cultivated under certain conditions, fertilization with iron carbonate being the most important of these. By this procedure the roots may be cultivated so as to contain 0.447 per cent. of iron. The dosage of the pulverized root is from 7½ to 11 grains given in powders or capsules at meal-time. The best results are obtained from this drug in chlorosis and in the anemia of tuberculosis.

Milk as a Hemostatic.—P. SOLT (*Therapeutische Monats.*, 1906, xx, 479) has employed milk as a hemostatic in internal hemorrhage with excellent results. The milk is given by rectal enema, either warm or cold and in quantity of one pint to one quart. Rarely is a larger amount necessary, but at times Solt has injected three quarts at a time. The patient is placed upon his side and the buttocks are held together so that the enema may be more easily retained. The milk is always well borne, but sometimes the patients complain of distention. The treatment is useful in all classes of internal hemorrhages and especially those due occurring as a result of genital disorder in the female. Solt has employed it in profuse menorrhagia, uterine hemorrhage following abortion or due to retained placenta, in hematemesis due to gastric ulcer, in hemoptyses, and in hematuria due to vesical cancer.

The Quinine Treatment of Cholera.—E. B. FULLERTON (*Jour. Amer. Med. Assoc.*, 1906, xlvii, 1986) considers that quinine has always proved the best remedy in Asiatic cholera. The drug given in the form of the sulphate, in doses of 10 grains an hour, produces the best results. The bisulphate is more soluble and is more likely to be absorbed. For the purpose of disinfecting the intestinal tract the drug should not be given in solution, but should be taken moistened with only a little water. Only slight symptoms of cinchonism have been observed when the comparatively insoluble sulphate has been used. Larger doses than 10 grains have been given, but are likely to be followed by vomiting. The fear of markedly ill effects from the doses recommended may be set aside, as the lethal dose lies somewhere beyond one ounce of the drug, and, in addition, quinine is an antiemetic in cholera.

The Treatment of Arteriosclerosis.—OSBORNE (*Yale Medical Journal*, 1906, xiii, 115) states that in the prophylaxis of this condition muscular activity, nervous strain, and everything that tends to increase peripheral tension should be avoided. Large amounts of water or other liquids should not be taken, for they tend to overfill the bloodvessels. A modified, diminished, mixed diet, alcohol-free, if possible, without contractor stimulants, as caffeine, coffee and tea, spices or any drug, such as strychnine or digitalis, unless there is actual cardiac failure, will give the best results. Physical and mental rest are of great value; the moderate use of tobacco, after thirty years of age, may be of benefit in instances of hypertension; in excessive amount it will, however, precipitate cardiac insufficiency. If there is no kidney or liver involvement the vasodilatation resulting from a little alcohol at night may be of benefit, but the same results may be obtained from small doses of glyceryl nitrate ($\frac{1}{100}$ grain) three or four times a day. The artificial serum of Trunecek may be employed hypodermically. This consists of a combination of small amounts of sodium chloride, sodium sulphate, sodium carbonate, and potassium sulphate in distilled water. These substances may also be given by the mouth. Their efficiency is based on the theory that they introduce into the circulation a solvent which will dissolve the calcium phosphate which has been deposited in the bloodvessel walls, but the originator claims that all the disagreeable symptoms due to hypertension disappear under this treatment and that blood pressure is positively lowered.

The Intravenous Injection of Strophanthine.—FRAENKEL (*Deut. med. Zeit.*, 1906, No. 62, p. 695) employs strophanthine intravenously in instances of cardiac insufficiency such as usually are benefited by digitalis. The dosage is from 12 to 15 minims of a 1 to 1000 solution, and the effects of the administration of this amount become evident within a short time; the pulse becomes fuller, the dyspnœa is relieved, and diuresis is established. The great advantage of the treatment is that all digestive disturbance is avoided, but it must be remembered that a second dose should not be given before the effect of the first has worn off, which would seem to show that strophanthine has a cumulative effect. Subcutaneous injections of strophanthine are very painful, but its intravenous administration is attended by no such untoward effect.

PEDIATRICS.

UNDER THE CHARGE OF

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Retarded Cerebral Development due to other than Cerebral Causes.—ERNEST LAPLACE (*Penna. Med. Jour.*, January, 1907, p. 277) refers to a class of children whose heredity is not shrouded in suspicion and whose environment likewise is good, but who, nevertheless, are backward and are mentally and physically below par. They are slow in retaining mental impressions, they show little or no tendency to learn to talk, suffer with a variety of nervous phenomena, and have every evidence of imperfect nutrition; they are mouth breathers, and present exacerbations of temperature, which depress more or less the nervous system. With the exclusion of abnormality in the shape or development of the head, and of the history of a previous meningitis, the examination of these children reveals with wonderful frequency the presence of three abnormal conditions, namely, postnasal and pharyngeal adenoids, tongue-tie, and phimosis.

The pathological results of these deformities can be classified as follows: (1) From the adenoids, improper and insufficient aeration of the blood, resulting in insufficient combustion and imperfect general nutrition, and impairment of hearing resulting in sluggishness and lack of interest. (2) From the tongue-tie, a hampered condition of the tongue in its attempts to articulate. (3) From the phimosis, an attendant reflex irritation of the nervous system and the general depression which soon follows.

A number of such patients have come to Laplace's attention. Almost without exception boys present the combined defects mentioned. The condition has not been found proportionately as frequent among girls, inasmuch as the tongue-tie and adenoids would be the only causative elements. Surgical correction of these frequently associated defects, carried out in 82 cases under Laplace's care, has been followed by most encouraging results, and seems to confirm his suspicion that this strange coincidence of defects in the same patient often contributes an important factor in the retardation of mental progress.

Tetany Considered as an Intoxication by the Salts of Calcium.—W. STOELZNER (*Jahrb. f. Kinderheilk.*, 1906, xiii, 661) states that Finkelstein has called attention to the fact that frank or latent tetany can be influenced by diet. He has observed that with such patients the galvanic hyperexcitability of the nerves, as well as most of the other symptoms, are aggravated by the administration of cows' milk. On the contrary, after purgation and institution of a watery diet, the phenomena disappear completely in the course of twenty-four hours. Cereals prepared without milk act in the same way. But if after this ameliora-

tion cows' milk is given the symptoms reappear. In investigating the cause of this action of cows' milk Finkelstein has been able to establish the fact that casein, butter fat, sugar of milk, and even human milk, when added to cereals, are without action on the tetany. On the contrary, the serum of cows' milk acts exactly in the same fashion as whole milk—whence he has concluded that tetany is determined by a disturbance in the nutritive processes depending probably upon the assimilation of the phosphates or the calcium salts. This point has been made the subject of Stolzner's study of the galvanic excitability of the peripheral nerves in infants affected with tetany, before and after the administration of cows' milk or the calcium salts.

While the 12 cases reported by the author are not equally significant it seems conclusive that the administration of cows' milk or the calcium salts caused a manifest exaggeration of the excitability of the peripheral nerves, while this effect was wanting when, as a control, these infants received phosphate of sodium, lactate of iron, acetate of potassium, chloride of sodium, or magnesia.

The mechanism of this action of the calcium salts in producing or exaggerating the symptoms of tetany is thus explained by Stoelzner:

Tetany is exceptional with the breast-fed infant, but is almost always observed with infants nourished by cows' milk, which contains five times more calcium than human milk. The absorption and elimination of calcium salts being effected by the intestinal mucosa, it is evident that this organ is subjected to a superalimentation, which is aggravated if there are digestive disturbances, or if there is rachitis, in which the bones imperfectly utilize the calcium absorbed. It may, therefore, result with infants nourished with cows' milk, whether or not they become dyspeptic or rachitic, that the intestine can become functionally insufficient in eliminating the calcium salts and thus lead to a retention manifesting itself clinically by tetany. It remains to be proved whether in such cases the blood and organs are surcharged with calcium salts, a point upon which so far no researches have been made.

A Vegetable Broth Useful in Gastro-enteritis.—Bailey (*Gaz. hebd. des Sci. méd.*, June 2, 1906) gives a recipe for a broth which may be used with advantage when it is necessary to interdict milk as a food in case of milk infection: Carrots, 65 grams; potatoes, 5 grams; turnips, 25 grams; dry peas or dry haricot beans, 25 grams, for each liter of water. Cook well and strain, adding 5 grams of salt per liter.

The Alimentary Regimen of Measles.—E. Ramus (*Régime alimentaire à instituer dans la rougeole, Thèse de Paris*, 1906) makes some valuable suggestions as to diet of children suffering from measles, based upon a study of urinary elimination and the weight. Dividing the duration of the disease into periods of four days each, counting from the day of eruption, Ramus has observed that the quantity of urine passes through three phases: First, a phase of oliguria corresponding to the first period of the disease; a second phase of polyuria coincident with the second period; and a third, covering the last two periods, in which the quantity increases, diminishes, or remains stationary. This curve, which is more

or less accentuated according to the gravity of the disease, is independent of the regimen adopted.

The elimination of urea shows notable modifications during the course of the disease. In the first period it is low; in the second it increases progressively, attaining a maximum from the ninth to twelfth day, after which it reverts to the normal. The administration of an albuminoid diet does not appear to increase the proportion of urea during the first period; it does augment urea elimination, however, during the subsequent periods; but it is impossible to establish an absolute parallelism between the curves of urea, the urine, and the course of the temperature.

The elimination of chlorides is not influenced by measles, and neither retention nor crisis is observed, as exists in other infectious diseases: the elimination is equal to the ingestion. No connection can be established between the excretion of chlorides, on the one hand, and that of urea, on the other.

The weight of the body in the course of measles undergoes a more or less considerable decline from the beginning of the incubation. In the following periods it remains stationary, to increase again without always attaining the original figure before complete recovery.

The chlorides seem to have a manifest influence upon the weight; if ingested from the beginning of the disease they retard the loss of weight, often so considerable during the first period. This attenuation cannot be attributed to fixation of water in the organism, since there is no retention of chlorides during the course of the disease. The role of the chlorides seems to be a biological one, consisting in a favorable modification of the phenomena of cellular nutrition.

The alimentary regimen proposed by Ramus is as follows: In the first four days of the disease it is useless to give albuminoid foods, since the child does not eliminate more urea under milk feeding than under barley-water. Give therefore water in the form of warm infusion of potherbs or mallow, barley-water or hot lemonade. To prevent too great a loss of weight, add to this a certain amount of sodium chloride, a little greater than that which would be taken in milk, about 5 grams for a child of from four to ten years. In the second period, after the fall of temperature, albuminoid foods may be resumed, since there is a sensible diminution of urea in children who do not receive albumin. Therefore, according to the appetite of the child and the condition of the alimentary tract, without recourse to an intermediate diet of milk exclusively, one can order without danger a diet suitable to the age of the child: broths, eggs, meat-juice, rice, butter, etc., watching always the condition of the stools, and reducing the diet if diarrhœa appears. In this way many of the complications resulting from the pronounced exhaustion of the disease may be avoided.

OBSTETRICS.

UNDER THE CHARGE OF

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Eclampsia.—Esch (*Ztschr. f. Geb. u. Gyn.*, 1906, lviii, Heft 1) contributes a paper upon this subject from studies made in Olshausen's clinic in Berlin. Between the years 1900 and 1905, in 6657 cases of labor, eclampsia occurred in 7.45 per cent. This is a high rate for continental clinics, the nearest approach to this in Germany being that of the Leipsig clinic, with 2.07 per cent. Of these, 78.3 per cent. were primiparæ, 21.7 multiparæ. Among the primiparæ were 14.8 per cent. older than 28. Nine of these patients had eclampsia in a previous pregnancy or parturition. Cases are on record in which the mother has had eclampsia in three successive pregnancies. Esch reports 3 patients who had eclampsia comparatively early in pregnancy, from which they recovered and subsequently had eclampsia at the time of the birth of the child. He adds also 9 other cases in which eclampsia occurred without the interruption of pregnancy, which subsequently went on to term. Among the symptoms of threatened eclampsia, the most significant was headache. Pain in the stomach and vomiting occurred just before or during convulsions. Disturbance of the special senses, especially sight, was frequently observed. An aura was not detected. The results of Esch's studies, with those of Olshausen and others, show clearly that eclampsia may occur after labor. The percentages are: Esch, 15.7 per cent.; Olshausen, 14 per cent.; Goedecke, 18.2 per cent.; Knapp, 14.6 per cent.; Goldberg, 16.88 per cent.; Winckel, 17 per cent.; Löhlein, 23 per cent.; Braun, 24 per cent.; Schauta, 24.6 per cent.; Büttner, 32 per cent.; Wirz, 19.7 per cent.; Hammerschlag, 19 per cent.; and Bidder, 29 per cent.

Eclampsia may develop as late as two days after labor. In one case reported by Esch, convulsions occurred nine days after the birth of the child. The longest interval reported between childbirth and eclamptic convulsions is eight weeks.

On admission, most of these patients were comatose, with labored respiration, rapid pulse, frequently with high tension, sometimes small and irregular. The patients were exceedingly restless and more or less unconscious. A moderate degree of fever was often present. Œdema was observed in the majority of cases in some portion of the body. In a considerable portion of cases the urine showed serum albumin. The specific gravity varied from 1010 to 1018, the urine was more highly colored than normal, and occasionally dark or reddish brown. The quantity was lessened. As a rule, immediately after labor the quantity increased or the albumin lessened. Debris from the kidneys was present in a large percentage of cases.

The convulsions were characteristic of eclampsia or epilepsy, and lasted from three-quarters of a minute to two or three minutes. The longest duration was twenty-two minutes. The number of convulsions

varied greatly. One patient had 146 convulsions; 2 patients had none, a condition considered exceedingly rare. In the patient who had 146, 5 occurred before labor, and 141 after labor. On the fourth day after the birth of the child the patient had 65 convulsions. While it is true that in many cases convulsions cease after the birth of the child, this is not invariably the case. It is probably safe to say that convulsions will cease in 49 per cent. of cases after the uterus is empty. Forceps was used in 141 cases in the ordinary manner; in one case upon the after-coming head, and thirty-three applications were made. The number of operations in all was 267, which gives a percentage of operative interference of 77.6 per cent. Of these, 121 were performed upon patients in whom the vaginal portion of the cervix was still present and undilated.

Of the 496 patients, 106 died, or 21.4 per cent. The greatest mortality occurred in March and in November. Occasionally groups of cases were seen in which the mortality was enormously in excess, as during a few days in the early winter of 1905 and 1906, when 4 of 5 eclamptic patients died; 6 of these patients died before labor, and one died as late as on the nineteenth day after labor; 91 of these women died as the immediate result of eclampsia; of the others, 16 died from complications. Autopsy was obtained in 70 of these cases; 4 of these had septic infection, but in none of these could the infection be traced to operation.

There were 31 patients on whom the Bossi dilator was used; of these 14 died; 12 of these cases came to autopsy. In 8 of them the pathologists reported no laceration of the cervix; in 3, slight laceration upon one side; in 1, an extensive laceration. One of these patients died of septic infection, the others of eclampsia. It is thought to be remarkable that so little septic mortality developed in cases in which the cervix was so little dilated, and the Bossi dilator was employed. Attention has been called to the dangers of the use of anesthetics in these cases, and especially prolonged narcosis, which favors the development of pulmonary complications. The length of time necessary for dilating the cervix varied from five to sixty minutes. It could scarcely be proved that the length of time occupied in dilatation had a direct influence on the mortality. In puerperal eclampsia the mortality was 15.4 per cent. When the convulsions did not develop until fourteen hours, or longer, after the birth of the child there was no mortality.

The number of convulsions had a direct relation with the mortality in the majority of cases. In some, however, death occurred after but one or two convulsions, and this is ascribed to the uncommon virulence of the poison.

High temperature accompanied a high rate of mortality, and is considered a most unfavorable symptom. The quantity of albumin present in the urine was of no importance whatever in basing a prognosis. When casts were very abundant, indicating a rapid disintegration of the kidney, the prognosis was bad. When the urine was highly discolored, the cases were also grave.

As regards the determination of the prognosis, it is stated that this is never possible with exactness. When the patient is not deeply unconscious, breathes easily, and has a good pulse, the symptoms are comparatively favorable. In cases in which convulsions seem to be excited

by the pressure of the fetal head at birth, or by the taking of stitches, the prognosis is also better. When coma is deep, the pulse small and rapid, and the temperature rises, the prognosis is bad. Especially unfavorable are those subjects who pass into deep coma after the first convulsion. Icterus, hemoglobinuria, scanty secretion of urine, and anuria are all unfavorable. Those cases are most desperate which are seen by the physician after they have long been in convulsions, and are excessivel weakened. Cases of p imiparæ above the average age, and patients having great quantities of albumin, with abundant casts, are also unfavorabl . If a patient improves after the birth of the child, such improv ment is most promising. When this is absent, the prognosis is grave. An especially significant symptom is headache, which should grow very much less, or disappear, after the birth of the child. Especially dangerous are puerperal complications in the lungs, such as inspiration pneumonia or bronchopneumonia. The mortality of eclampsia is less in cities than in the country, b cause in cities patients obtain more prompt and efficient treatment.

The chance for the child is less favorable than for the mother. Olshausen believes that few children survive twelve or fifteen convulsions. Glockner observed that when more than ten convulsions occurred before the birth of the child, that but 17 per cent. of the children were born living. Narcotics given to the mothers affect the children unfavorably. When large doses of opium are given, the children are born narcotized and require active treatment for resuscitation. The mortality among children in these cases was 22.7 per cent. Others give a percentage ranging from 28.44 per cent. When spontaneous birth occurred the mortality was 15.7 per cent. When operation was necessary, it rose to 31.9 per cent. The mortality of 22.7 per cent. is unusually low, and is ascribed to the active treatment employed. Other observers give this mortality as ranging from 31 to 49 per cent.

It is remarkable that so few children born of eclamptic mothers have convulsions. In some cases the child's eclampsia occurs during its first bath. The children of eclamptic mothers should be guarded against irritation or excitement likely to induce convulsions.

As regards treatment, statistics are quoted which seem to show that immediate delivery gives the best results. In Esch's experience, rapid delivery by Bossi's dilator, or Dührssen's vaginal section, increased the mortality 4.5 per cent. Rapid delivery is not a panacea for eclampsia It is true that convulsions cease in the greater majority of cases after the birth of the child, but this does not prove that recovery will take place.

Dividing his cases into three periods, Esch tried during the first period incisions in the cervix, varying in length, followed by delivery. The mortality rate was 28.9 per cent. During the second period, incisions were made less frequently, and Bossi's dilator was introduced. The mortality was then 27.87 per cent. During the third period, in addition to other methods of treatment, vaginal Cesarean section was performed, when the mortality fell to 19.8 per cent.

When a comparison is made between different classes of cases, and the statistics of other operators are taken into consideration, it is found that the emptying of the uterus must be chosen with regard to the condition of each individual patient. When delivery is selected, the use

of forceps is usually made available; occasionally version with extraction; when the child is already dead, perforation and the use of the cranioclast.

When non-operative treatment is considered, morphine, chloral, bromide of potassium, are used, in accordance with individual indications. Narcosis is employed for all interference. Stimulants are given to excite the action of the heart. During the puerperal period the diet is milk, and acetate of potassium is administered as a diuretic. During operative delivery, ergot is given hypodermically. When Cesarean section, abdominal or vaginal, is made the patient receives an injection of ergot fifteen minutes before the operation. In all cases, the patient is disturbed as little as possible, and a bright light is carefully excluded from the room. When respiration is labored, the foot of the bed is raised and the patient's head turned to one side to permit the free escape of secretions from the mouth. The mouth is frequently cleansed with sterile gauze. Wet compresses and packs are used to allay excitement, although they are thought to depress the patient greatly. Stimulating injections are frequently given before a pack. No diaphoretic treatment is carried out, as it is thought to be useless or harmful.

Esch did not try spinal puncture or spinal injections of scopolamine and cocaine. In plethoric cases, bleeding followed by subcutaneous injections of salt solution proved useful.

The ideal treatment is prophylaxis, and especially the strict regulation of diet during pregnancy. In making incisions in the cervix, the anterior and posterior portions are selected. Usually two incisions suffice.

Hemorrhage and laceration in these incisions was not observed. They were not closed by stitches after the birth. In employing the Bossi method, the instrument devised by Frommer is employed. When vaginal Cesarean section is done, anterior incisions are usually made. When this does not suffice, then incisions are made posteriorly. The child is delivered by version and extraction. In primiparæ, deep, lateral incisions are sometimes made through the labia.

GYNECOLOGY.

UNDER THE CHARGE OF

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Origin of Embryomas.—FREUND (*Zentralbl. f. Gyn.*, 1906, No. 44) raises the question whether embryomas may not develop from aberrant blastomeres, as well as in accordance with Bonnet's theory of congenital inclusions. He believes that the clinical symptoms of this class of neoplasms nearly always point to a previous pregnancy, the fetal inclusions being developed under the influence of puerperal changes. It is conceivable that besides the fruitful ovum a second may be fecundated at the same time, and that this perishes except a single blastomere.

This theory is supported by the fact that in some cases the usual changes in the uterus and breasts and the presence of the corpus luteum of pregnancy have been observed in connection with an ovarian embryoma. Certain striking changes which take place in the walls of dermoid cysts, not observed in other varieties of cystoma, may be regarded as a peculiar reaction of the ovarian remains to the implantation of a blastomere, like the dilatation and increased growth of the lymphatics seen in the pregnant uterus. The fecundation of an ovum in the atrophied stromal remnants of a cystoma may also result in the development of an isolated blastomere and thus lead to the formation of an embryoma.

Removal of the Ovaries in Myomotomy.—ROCHARD (*Bull. gén. thér.; Zentralbl. f. Gyn.*, 1906, No. 43) pleads for extirpation of the adnexa in every case of hysteromyomectomy, since the ovaries may subsequently become inflamed and cystic, or serious intraperitoneal hemorrhage may result from ruptured follicles (?). He thinks that the arguments advanced for preservation of the ovaries after removal of the uterus are not convincing, the reflex disturbances being unimportant and the theory of internal secretion fanciful. (It is evident that this paper is based on limited clinical experience, else the writer would not indulge in dogmatic statements, opposed to that of the majority of abdominal surgeons.—H. C. C.)

Operations for Recurrent Carcinoma.—FRANZ (*Zentralbl. f. Gyn.*, 1906, No. 44) reports 16 such operations for recurrent disease following hysterectomy; 9 patients were operated upon once, 2 twice, and 1 three times. In 9 there were no complications; in 2 the base of the bladder and portions of both ureters were resected, and in 1 a ureterovaginal fistula was cured; in 2 resection of the large intestine was necessary, while one kidney was extirpated in two instances.

One patient died after removal of a pyonephrotic kidney and one of embolus two weeks after operation; a third succumbed from extension of the disease six months later.

Franz believes that whenever possible the patient should have the benefit of surgical treatment; though life is thus prolonged and pain relieved, a permanent cure can rarely be hoped for. The indications for operation are limitation of the growth and a certain degree of mobility, showing that it is not firmly adherent to the pelvic wall. Care should be taken to avoid injury to the rectum and bladder, and it is indispensable that the kidneys should be in a healthy condition.

Peritoneal Adhesions.—PANKOW (*Zentralbl. f. Gyn.*, 1906, No. 44) from experiments on animals arrives at the following conclusions: No adhesions result from superficial lesions of the visceral or parietal peritoneum, even when cauterized. In 50 per cent. of the cases in which the parietal peritoneum was roughly scraped, or punctured at several points, adhesions occurred. Slight adhesions resulted when the cautery, or alcohol, was applied to check oozing. In artificial staphylococcic infection it was found that the power of resistance was greatly lessened when the peritoneum was injured, especially if the raw surfaces were touched with the cautery or with alcohol.

Ovarian Pregnancy.—SCHICKELE (*Zentralbl. f. Gyn.*, 1906, No. 44) adds a third case to those reported by Franz and Van Tussenbroek. In one there was no question that the fecundated ovum lay within a ruptured follicle; in another, the remains of the ovum besides the fresh corpus luteum were free in the tissues, so that the fetal cells were in direct contact with the maternal connective-tissue cells. In Schickele's case the ovum was in close contact with the corpus luteum and had caused marked distention of its wall. In both of the last two cases the ovum was imprisoned within the stroma (epovarian implantation), in contrast to the intrafollicular situation.

Structure and Changes in Intraligamentary Tumors.—SCHÄFFER (*Zentralbl. f. Gyn.*, 1906, No. 44) from a study of serial sections of an intraligamentary fibroid found that the abdominal portion of the neoplasm was cystic while the intrapelvic was fibromyomatous, receiving its vascular supply from the anterior fold of the base of the broad ligament, and having no connection with the uterus. Myxoid degeneration and pseudocysts were noted. In the capsule of the cystic portion of the tumor were large hard nodules resembling organized tissue, quite vascular. The arteries were greatly dilated, their walls showing hyaline changes, and terminated in capillaries which penetrated the myxomatous and œdematous tissue, the degenerative processes being most marked at a distance from the hilum, or point of entrance, of the nutritive vessels.

Vapocauterization of the Uterus.—BAISCH (*Frauenärzt*, November 16, 1906, p. 504) believes that the therapeutic action of vapocauterization depends mainly on the condition of the endometrium. Since we cannot know beforehand the pathological lesion, we cannot affirm what will be the exact result. He is opposed to its use in young women, on account of the result on menstruation and conception. In those who have reached the climacteric other changes may be present, such as arteriosclerosis, so that vapocauterization may have no more effect than simple curettement.

Previous curettement is advised, from five to seven days being allowed to elapse before vapocauterization is used, an anesthetic being then unnecessary. It is absolutely contra-indicated in cases of uterine fibroid, as well as in gonorrhœal and septic endometritis.

He would limit the employment of this agent to cases of uncomplicated preclimacteric hemorrhage.

Bier's Method of Intra-uterine Treatment.—ZURAN (*Zeit. f. Gyn.*, 1906, No. 28, p. 785) finds that the introduction of Bier's catheter is free from danger, provided that strict asepsis is observed. It relieves dysmenorrhœa, diminishes the secretion in cases of chronic endometritis, and exerts a curative action on the diseased endometrium, which extends to the submucosa. This method of treatment may be used in dispensary practice and does not interfere with the patient's occupation.

Thrombosis of the Vessels in Ectopic Gestation.—FELLNER (*Archiv f. Gyn.*, 1906, Band lxxiv, Heft 3) describes the anatomical conditions in three cases of early tubal pregnancy. Numerous arteries in the neighborhood of the intervillous space were seen filled with round and spindle

cells, which Fellner believed to be not of ectodermal origin, but derived from the subendothelial connective tissue. He regarded the condition as an "autothrombosis" in the arteries, and not as an escape of Langhans' cells into the veins, as stated by Veit and others.

He suggests that the invasion of the vessels of a myomatous uterus by villi, described by Poten, is really an arterial autothrombosis—hence the frequent occurrence of abortion in such uteri. Moreover cases of so-called chorion epithelioma may be explained in the same way.

Malignant Degeneration of Uterine Fibroids.—WINTER (*Zeitschrift f. Geb. u. Gyn.*, 1906, Band lvii, Heft 1, p. 8) remarks on the extreme rarity of cancerous degeneration of fibromyomas of the uterus. Among 2331 cases of uterine cancer the body was affected in 151, myomas being present in 80. Hofmein, Fehling, and Winter together note 1.2 per cent. of cases of cancer of the corpus uteri with coexisting fibroids. In 1270 cases of cancer ot the cervix uteri there were 2 per cent. of fibroids, hence the fear that the stump may become cancerous after supravaginal amputation is practically groundless. When the symptoms of cancer appear in connection with fibroid uteri (especially atypical hemorrhages and discharges after the menopause) the presence of adenocarcinoma should be suspected and total extirpation is preferable.

The question of sarcomatous degeneration is different. Among 1734 cases of fibromyoma, 46 underwent sarcomatous degeneration (2.7 per cent.). This change is most likely to occur in the submucous variety (about 9 per cent.).

In conclusion, Winter lays little stress upon the danger of malignant degeneration of fibroids as an indication for operation, though he admits the frequency of cystic, suppurative, and other benign changes.

Results of Radical Abdominal Hysterectomy for Uterine Cancers.—BRUNET (*Archiv f. Gyn.*, 1906, Band lxxviii, p. 632) reports 251 cases in which the uterus, parametric tissues, and lymph nodes were examined microscopically after removal. He notes that the average operability is only 30 per cent., the average mortality being 15 per cent. He still advises radical removal of the diseased organs and tissues, even the upper third of the vagina, as well as the broad ligaments and glands. No comments are made with regard to the permanency of the "cure."

Premonitory Bleeding in Ectopic Gestation—SCHICKELE (*Zentralbl. f. Gyn.*, 1906, No. 44, p. 1227) calls attention to the fact that slight hemorrhages from an ectopic sac preceding the final intraperitoneal rupture may easily lead the observer to infer that the case is one of simple tubal abortion. It is well known to every operator that such premonitory hemorrhages often occur, as shown not only by the finding of small openings in a sac removed between the third and fifth months, but by the presence in the cavity of blood clots of different ages. (This interesting paper only serves to emphasize the importance of early operation, or at least of diagnostic vaginal section, at the first appearance of suspicious symptoms, whether associated with a tumor or not. No case of ectopic gestation should be allowed to progress as far as the third month.—H. C. C.)

DERMATOLOGY.

UNDER THE CHARGE OF

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A Case of Dermatomycosis Caused by Microsporon Canis.—NICOLAS and LACOMME (*Annales de Dermatologie et de Syphiligraphie*, 1906, No. 4) report the following case: A man, aged thirty-seven years, complained of generalized itching, most marked on the anterior and lateral surfaces of the thorax. No evidences of scabies or pediculosis were found, but on the anterior surface of the chest, about the middle of the left clavicle, and in the left axilla were two erythematosquamous patches about the size of a two-franc piece. Microscopic examination of scales from these plaques revealed the presence of numerous mycelial threads. Upon interrogating the patient it was learned that he was in the habit of playing with a dog which presented typical lesions of tinea tonsurans. By means of culture and inoculation experiments, the identity of the fungus found on the patient and that obtained from the dog was established, the fungus being identified as Microsporon canis. The disease rapidly disappeared after the use of sulphur baths accompanied by frictions with black soap, and painting with tincture of iodine.

A Case of Folliculitis Cutis Gonorrhoica.—CRONQUIST (*Archiv f. Dermatologie und Syphilis*, Band lxxx, Heft 1) reports the following unusual case of gonorrhœal infection of the skin: A young man, aged twenty-one years, suffering from a gonorrhœa of one week's duration, with the usual symptoms, an abundance of gonococci being found in the urethral discharge, presented a pea-sized, markedly inflammatory nodule situated a short distance below the umbilicus. Upon removal of the crust which covered its top a drop of greenish pus welled out in which gonococci were demonstrated. Microscopic examination of the lesion showed that the process was a folliculitis and perifolliculitis and its gonorrhœal nature was proved by the reaction of the pus with the Gram stain. (Cases such as above, and a few others reported by other observers, prove conclusively that the gonococcus may give rise to cutaneous disease.—L. A. D.)

Two New Cases of Porokeratosis.—MIBELLI (*Brit. Jour. of Dermatology*, May, 1906, p. 197) states that about forty cases of this disease have been published. Two new cases are recorded, both occurring in field laborers, one young, the other old, the regions affected in both being the face, hands, legs, and genital region. The chief manifestation consists of a hyperkeratosis together with the characteristic feature of the depressed furrow of the lesion. The process is regarded by Mibelli

as being really a porokeratosis rather than a hyperkeratosis. Later atrophy takes place in the diseased areas, which are thus found when the sebaceous glands and the hair follicles are equally destroyed. In addition to these changes there is a slight infiltration of the corium with mononuclear leukocytes, together with disappearance of the elastic network and a thinning of the callogen bundles. This deeper inflammation is probably the sequel of the hyperkeratosis rather than *vice versa*. The histological facts may be summed up by stating that the disease is a hyperkeratosis with porokeratosis, followed by inflammation of the corium and, finally, atrophy, the hyperkeratosis electing the glandular and follicular apertures, with special reference to the sweat ducts.

Pathology and Therapy of Yaws.—ALDO CASTELLANI (*Jour. of Trop. Med.*, January 1, 1906) concludes that both the lesions and the treatment go to show that yaws (known also as frambesia, parangi, pian, etc.) is distinct from syphilis. The early lesions of yaws show a spirillum, for which he proposes the name Spirochæta pertenius, but this spirocheta does not prove that the disease is identical with syphilis. Large doses of potassium iodide he found useful in yaws, and much more effective than mercury. Some cases recover without treatment.

Mucous Membrane Lesions in Lupus Erythematosus.—THOMAS SMITH (*Brit. Jour. of Dermat.*, February, 1906) has made a study of fifty-six consecutive cases of lupus erythematosus and has found that sixteen had some affection of the mucous membrane, giving a percentage of 28, which is greater than the prevalent idea. The majority of the patients were unaware of the existence of any lesions in the mouth. All had been patients at the London Hospital recently, the observations having been corroborated by Dr. Sequeira in nearly every case. In no instance of the noted cases was the tongue affected. The mucous membrane lesions were more frequently encountered in cases of the disseminated type. The locality affected was generally the inner surface of the cheeks. The lesions do not materially affect the course of the disease of the skin and do not appear to demand any special local treatment.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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Studies in Beriberi.—HERZOG (*Philippine Jour. of Science*, 1906, i, 169) in two papers discusses beriberi, with special reference to the very obscure question of its etiology. In the first paper the author

gives an account of his work in the Japanese Army Hospital during the late war. He points out that although the very efficient sanitary arrangements in the field were successful in combating typhoid fever, dysentery, scorbutus, and typhus fever, beriberi, or kakke, as the Japanese call it, was not preventable or apparently controllable in the actively employed army. Herzog gives an account of the work of Okata and Kobubo, who have isolated a coccus from numbers of cases of beriberi. The blood of 129 cases was examined, both microscopically and with cultures, and sixty-five times both methods were successful. In 35 cases the organism was not found by either method, and in 11 the microscope alone revealed it, while in 19 cases this method was negative, but successful cultures were made. The organism usually occurred as a diplococcus, but at times as a staphylococcus. In smears it was seen both within and outside of leukocytes. It never showed a capsule or motility. It grows readily on the usual culture media. All animal inoculations were unsuccessful. The coccus was isolated by these Japanese authors twenty-five times from the urine of 34 patients, and obtained fifteen times from the feces of 45 patients. Herzog obtained it eight times in 30 to 40 attempts at isolation from the urine of patients suffering with beriberi.

The second paper is a more general account of the disease, and is based upon the study of beriberi as seen in the Philippine Islands. The various etiological factors for the disease, which have been more or less hypothetically advanced, are discussed. In order to test the idea of Donald Ross that the disease is caused by arsenical poisoning, the hair of the patients was analysed for arsenic, with negative results. Herzog has undertaken an extensive study of the Okata-Kobubo coccus, and finds that the strains of the organism which he used corresponded culturally almost entirely to the characteristics reported by the Japanese observers. His results with animal inoculations are entirely negative, although quite extensive. Six series of monkeys, guinea-pigs, rabbits, and rats were used, and observed over a long time. Blood cultures were made from 40 patients with better technique than that employed by the Japanese, and all were sterile except in 6 cases, in which the cultures were apparently contaminated. In one fatal case the Okata-Kobubo coccus was isolated from the much enlarged spleen, and with this organism all animal experiments were negative. Herzog was able to produce a very low grade of agglutinating serum by repeated injections of the organism.

He concludes that beriberi is neither primarily a nutritional disturbance nor a simple intoxication like lead, alcohol, arsenic, or similar intoxications accompanied with multiple peripheral neuritis, but is an infectious disease. His blood examinations and animal experiments indicate very strongly that none of the claims brought forward for the discovery of a specific micro-organism for the disease can be looked upon as substantiated. Herzog advances the hypothesis that the disease is due to some organism which gains entrance to the body and then produces an extracellular toxin, which may be compared to diphtheria and tetanus toxin, and which, by an accumulative action, gives rise to the well-characterized anatomical lesions of beriberi.

Researches on Immunity to Carcinoma in Mice.—EHRLICH has found that by injecting mice with spontaneous or transplanted avirulent

tumors an immunity can be obtained against virulent tumors. Repeated injections of avirulent material increase the immunity. Not only is there an immunity for the same type of carcinoma but for other strains, and if the immunity for carcinoma is carried to its maximum the mouse is likewise protected against inoculations of sarcoma. The reverse is also true; and in one case a mouse immunized against sarcoma showed partial immunity to inoculations of a transplantable chondroma. This question of "pan-immunity" has been tested still farther by Borrel, who failed in attempts to immunize mice against carcinoma by injections of the livers of mice, and by Bashford, who claims to have produced immunity against the Jensen tumors by injections of the blood of mice.

Schöne (*Münch. med. Woch.*, 1906, liii, 2517), working in Ehrlich's laboratory, has repeated these experiments. He has tried to determine if mice injected with various cells and tissues, other than the tumors of mice, develop any immunity against mouse tumors. For this purpose the embryos of mice, the livers and testicles of mice, chicken embryos and carcinoma of the human mammæ were used. Schöne found that repeated intraperitoneal injections of mice embryos seemed to protect the animals against subsequent inoculations of transplanted carcinoma. In a series of 18 inoculated mice 12 (or 66.67 per cent.) did not develop carcinoma four weeks after the inoculation, while in the 18 controls only 3 (or 16.67 per cent.) proved refractory. With the liver, testicles, chicken embryos, and mammary carcinoma the results were not striking; and though mice treated with these tissues seemed to be more resistant to the inoculations of carcinoma than the controls, the author thinks that the number of his experiments is too small for him to draw definite conclusions. A second series of mice which received repeated injections of the same tissues, except for the mammary carcinoma, showed no immunity against inoculations of a virulent sarcoma.

Active Immunization of Man against Typhoid.—Friedberger and Moreschi (*Deut. med. Woch.*, 1906, xxxii, 1986) prepare an exceedingly powerful vaccine by drying mass agar cultures in an exsiccator, and heating for two hours at 120° to 150° C. At this temperature the bacilli are killed, but the antigens are not destroyed. To test the value of the vaccine fourteen young men, who, of course, had not had typhoid, were inoculated. Injections were made intravenously. Doses of $\frac{1}{50}$ oese produced somewhat alarming symptoms, while much smaller amounts gave rise to high fever and chills. Indeed, the vaccine proved so active that 0.00078 milligram was sufficient to give rise to definite symptoms. After injections of the vaccine the serum of the individuals agglutinated the typhoid bacillus in high dilutions and showed a marked increase over the normal in bacteriolysis.

Typhoid Bacillus Carrier.—The name "bacillus carrier" was given by Forster and Kayser (*Münch. med. Woch.*, 1905, No. 31) to persons, who weeks or years after an attack of typhoid fever, eliminated typhoid bacilli, as proved by culture, in their stools. They described several such cases and suggested that the gall-bladder acted as a reservoir for the typhoid bacilli. Levy and Kayser (*Münch. med. Woch.*, 1906, liii, 2434) report the case of a woman who, in 1903, suffered an attack of typhoid fever. During the winter of 1905 typhoid bacilli were found

on ten different occasions in her stools. In October, 1906, she became ill and died of pneumonia. At autopsy the gall-bladder contained a concretion. Enormous numbers of typhoid bacilli were found in the bile, and were cultivated from the centre of the stone. Typhoid bacilli were also found in the spleen and liver. Levy and Kayser conclude that the gall-bladder is the seat of vegetation for typhoid bacilli in the "chronischer Bacillenträger," and point out, moreover, that from the gall-bladder an autoreinfection may take place.

Observations on the So-called Abnormal Fibrous Bands of the Heart.—TAWARA (*Ziegler's Beitr. z. path. Anat.*, 1906, xxxix, 563) has studied these fibrous bands which are not infrequently found in the ventricles, and either cross the cavities or run as isolated bands along the walls, and finds that in their direction they follow the course of the fibers of the atrio-ventricular bundle of muscle fibers. According to Tawara they represent isolated bundles of fibers forming a continuation of the muscular fibers of the main bundle. MAGNUS-ALSLEBEN (*Cent. f. Path. und Path. Anat.*, 1906, xvii, 897) has been able to demonstrate that these anomalous fibrous bands which he has examined in ten different hearts contain muscle fibers, sometimes separated or surrounded by connective tissue. The muscle fibers are characterized by the presence of much sarcoplasm. This, as Tawara has stated, together with scanty development of fibrils is typical of the muscle fibers which form the continuation of the atrio-ventricular bundle beneath the endocardium of the ventricles.

Agglutinins and Specific Immune Bodies in Gonococcic Serum.—VANNOD (*Deut. med. Woch.*, 1906, xxxii, 1984) has prepared a serum by inoculating rabbits with the nucleoproteid of gonococci which is highly agglutinative for the gonococcus. Though the gonococcic serum does not agglutinate staphylococci and streptococci it does agglutinate meningococci. A meningococcic serum agglutinates correspondingly the gonococcus. The gonococcic serum, however, contains antibodies, which are "bound" by the gonococcus, as tested by the method of complement deviation of Wasserman and Bruck; whereas the serum does not contain bodies that are bound by the meningococcus.

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